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ENVIRONMENT VIEWS

VOLUME THREE
NUMBER TWO
JUNE JULY 1980

SECOND CLASS MAIL REGISTRATION NUMBER 4405

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Alberta Government Photo

Water Resources Management: 1

ISSN 0701-9637

ENVIRONMENT VIEWS

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Environment Views is published bi-monthly by Alberta Environment. Each issue deals with a specific topic from various viewpoints with the aim of increasing awareness of environmental issues among Albertans. The views expressed by the publication are not necessarily those of Alberta Environment.

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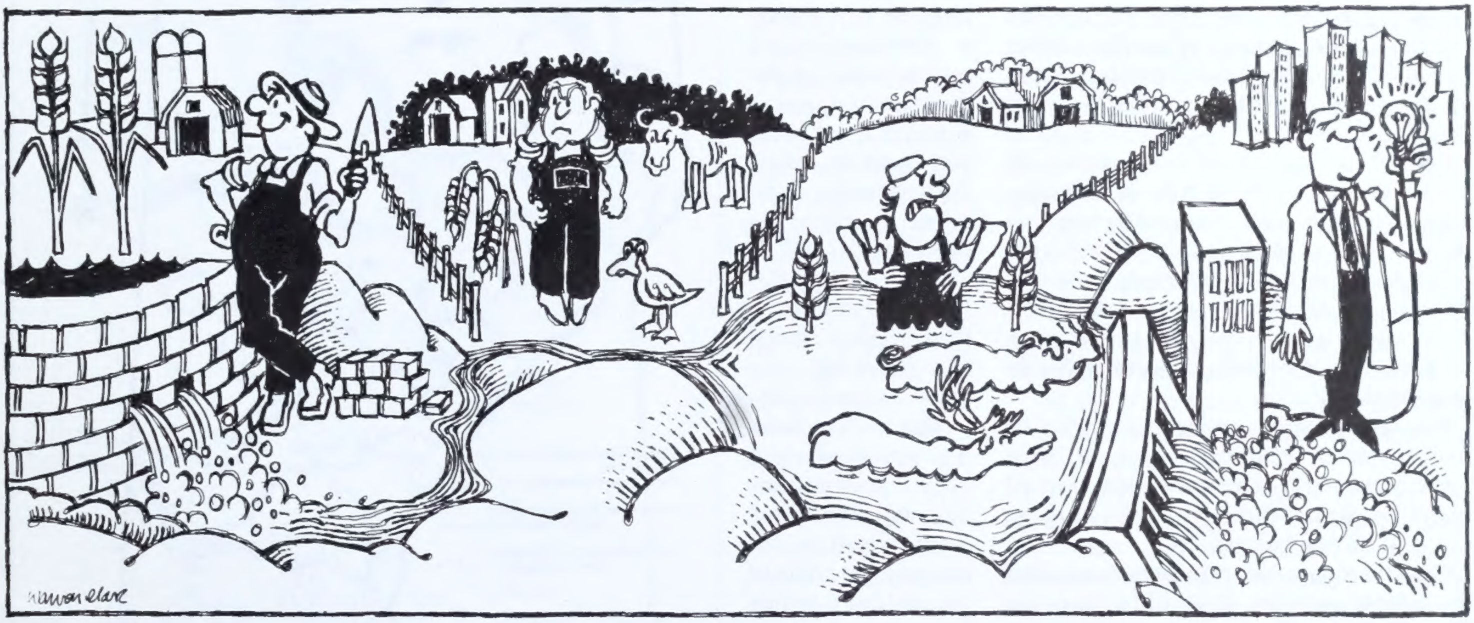
Alberta
ENVIRONMENT

Introduction: Gillian Sniatynski

Catching - And Sharing - Our Share

Water resources management in Alberta is a difficult and unpopular job.



It's hard to imagine another substance as widely necessary and useful as water. And it's not at all hard to appreciate that water supplies are precious, and not to be disposed of carelessly.

This issue of Environment Views considers some of the general principles and problems of water resources management. The next issue will consider other aspects of the subject, with a special focus on the major consumer of the province's water — irrigation.

Because of its geographic situation, Alberta is custodian of the watersheds of some of the country's major rivers. Water originating in the Rocky Mountains eventually reaches shores as far apart as the Arctic Ocean, Hudson Bay and the Gulf of Mexico. So water management decisions made here have interprovincial and international consequences.

Other unique factors have a bearing on those decisions. Climate, as well as topography, combine to create wide seasonal variations in river flow. Spring thaw sends torrents rushing down from the mountains to fill for six weeks or so river beds that have little flow at other times of the year. In the north of the province, overabundant water creates erosion problems, as the story on Page 14 shows. In the south, the spring flows may vanish into Saskatchewan and Manitoba unless we do something to capture our share.

The need to balance out some of the inequities of nature has produced the Prairie Provinces Master Agreement on Apportionment. The governments of Canada, Alberta, Saskatchewan and Manitoba agreed in 1969 that water in rivers flowing from west to east across interprovincial boundaries should be divided such that Alberta could consume 50 per cent of the natural flow originating in or flowing through the province. A quantity of water equal to the remaining 50 per cent must be permitted to pass downstream to Saskatchewan.

The apportionment agreement stands out as a landmark in interprovincial co-operation. It hasn't been as easy to reach agreement with the many competing water users within the province.

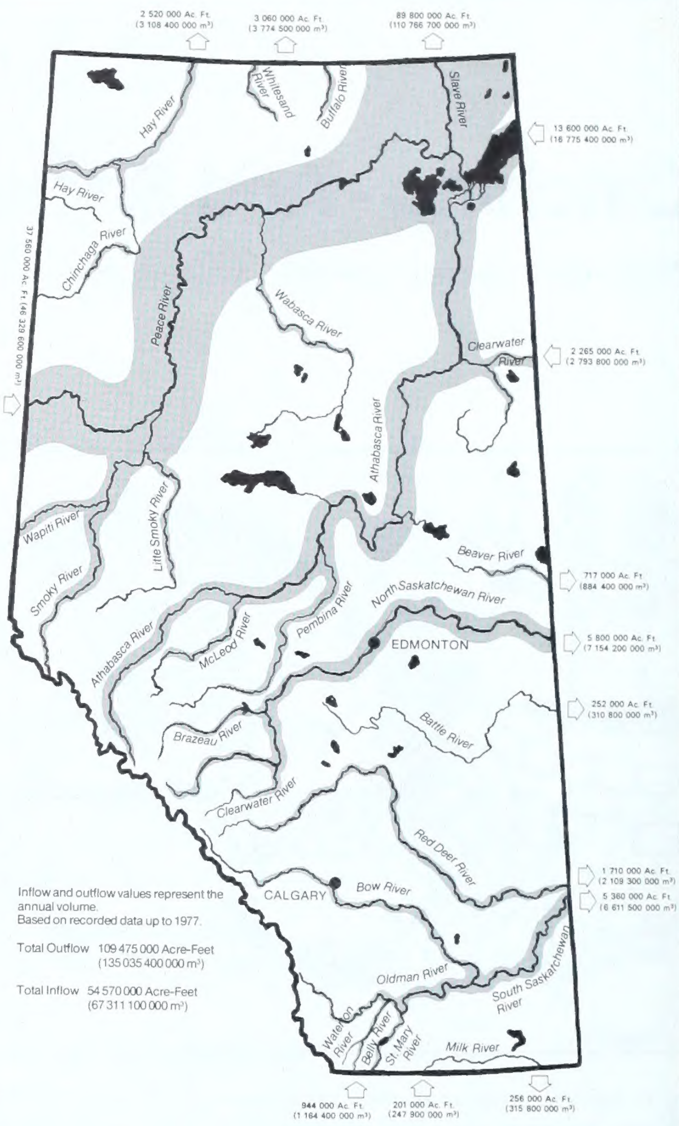
In part, that's a matter of population distribution. The southern half of the province, with about 80 per cent of the total demand, has only about 15 per cent of the total water supply.

Then, too, there's the nature of water itself. It influences so very many unrelated, indeed often opposed activities that competition between users is almost inevitable. You don't build a hydro dam in a prime fish habitat without angering fishermen, fisheries biologists, conservation associations and others. You don't forbid a major water-using industry near a similar fish habitat without upsetting local civic groups seeking to attract employment to the area.

Even within user groups, there is disagreement about the way water should be managed. Unifarm president Howard Falkenberg notes that when some farmers want water for irrigation, others often have to give up their land for the storage reservoir. The Alberta Wilderness Association's drive to have some of the province's rivers preserved and protected because of their "natural, recreational and historic value" might not appeal to less conservation-minded recreation groups.

Many of the stories in this issue — on hydro development (Page 25), farmers' water problems and their responsibilities

Mean Annual River Discharges



Inflow and outflow values represent the annual volume.
Based on recorded data up to 1977.

Total Outflow 109 475 000 Acre-Feet
(135 035 400 000 m³)

Total Inflow 54 570 000 Acre-Feet
(67 311 100 000 m³)

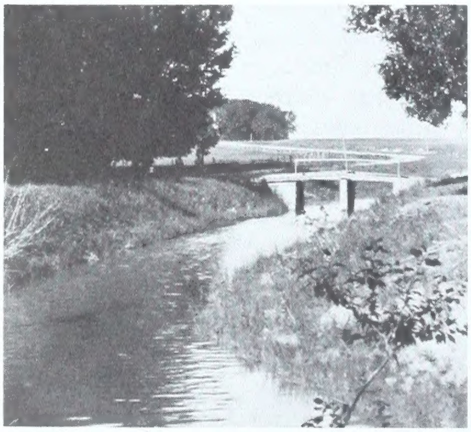
in solving them (Pages 11 and 17), and the work of Ducks Unlimited (Page 22) — focus on different user groups, and highlight some of the conflicts that can occur between them.

The job of juggling all the demands on the water supply falls to Alberta Environment, which, in view of the complexity of the decisions needed, and the potential for controversy between competing users, has developed a series of water management principles to guide its work. The interview on Page 8 deals with the department's role in more depth.

It is, for example, government policy to manage water resources on a river basin basis, rather than stream by stream. In all planning and development, multi-purpose use is to be emphasized.

Risks from dam failure must be reduced to the lowest practical level. (The story on Page 33 deals with dam safety.)

Above all, the water resources of Alberta "are to be managed in support of the overall social and economic objectives of the province."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Yet, perhaps because of the nature of the competing interests for water, and the impossibility of making decisions that will please all or even most users, Alberta Environment's water resource management decisions frequently make as many foes as friends.

Dr. Arleigh Laycock, professor of geography at the University of Alberta and director of its water resources centre, praises some of the department's recent work in river basin management, But he is one who has some concerns about its overall approach.

He notes that the United States Water Resources Council has declared two major — and equal — objectives of water resource planning to be (i) to enhance national economic development by increasing the value of the nation's goods and services and improving national economic efficiency, and (ii) to enhance the quality of the environment by the "management, conservation, preservation, creation, restoration or improvement of the quality of certain natural and cultural resources and ecological systems." Consideration of any project must include an accounting of good and bad effects on these two areas, and the related areas of regional development and social well-being.

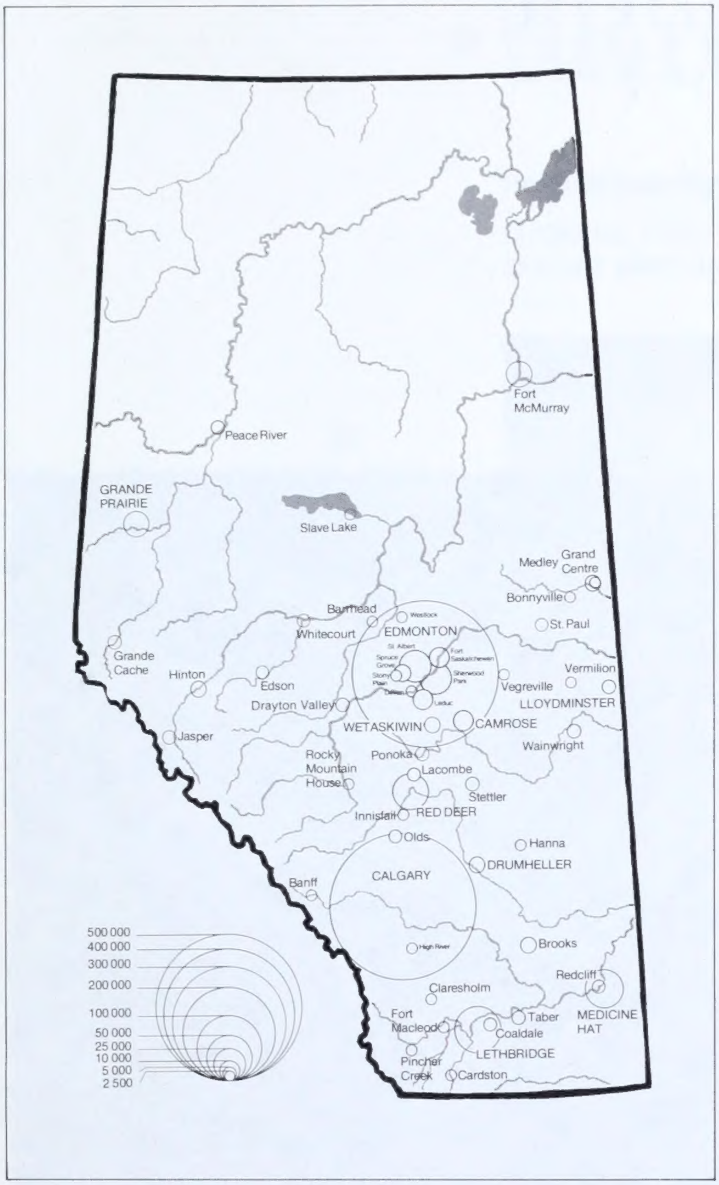
Laycock claims that Alberta Environment's management principles do not clearly articulate what its major objectives are, and that, in the absence of a more precise policy statement, the main objective must be assumed to be provincial economic development.

This gives him cause for concern on two counts. The first is that, if water management decisions *are* to be made on purely economic grounds, then they should *be* economically sound decisions, and not, as he feels, too often the result of inadequate cost-benefit analysis.

Laycock's second area of concern, and one echoed by other critics, is that an economic focus inevitably leads the department to favor structural solutions to water management problems; dams, the critics claim, are put on rivers with insufficient thought for alternatives which may solve the problem just as well with less environmental harm. Instead of building a dam to create a reservoir for irrigation, they ask, why not concentrate on improving the irrigation systems already in place in the area? Instead of building dikes to protect flood plain areas, why not instead aim to reduce flood damage by controlling development in flood-prone areas? And so on.

"Look at the record," is the response of Peter Melnychuk, Alberta Environment's assistant deputy minister for environmental engineering support services. "If you're looking at large structures . . . what dams have we built? We haven't built any. The only dam in the history of water resources that has actually been decided on is the Red Deer. And that's small in comparative terms."

Hydro dams require approval by a spec-



Population Distribution 1976

ial Act of the legislature, though their operation is licensed by Alberta Environment. All of the dozen or so hydro dams already in operation were built before the department was created.

Other dams are under review: a dam on the Oldman River for on-stream storage is being considered; a hydro dam has been approved for the Dunvegan site on the Peace River; a further hydro dam is under consideration for the Slave River at Mountain Rapids; and there is the possibility of a storage and flow regulation structure in the Milk River basin. So it's fair to say that there *are* some larger dams on the drawing boards.

"Large dams have been on the drawing boards since the beginning of time —that means nothing," says Melnychuk.

Within Alberta Environment, many of the decisions are made, and much of the work is done, by engineers. Rightly so, say Melnychuk and Carl Primus, head of the department's planning division.

"Managing water requires an engineering discipline," says Melnychuk.

"I think that implicit in the term 'management' is an active role," says Primus. "It has traditionally been felt that if you are going to manage something, you have to have the capability to change or manage from the natural regime. If we were fully satisfied with water in the natural state there wouldn't be any management required."

In making decisions about water resources management, those engineers are certainly not working in isolation from others of different interests, in different disciplines. The intention is that consultation between all these interests will ensure broad-based decisions and proper consideration of environmental concerns.

But it would be naive to assume that things go smoothly all the time. The engineer thinking about designing a dam, and the fisheries biologist seeking to mitigate its effects on fish habitat, not only have different academic backgrounds but are also dealing with vastly different sorts of data. Consultation between the two requires some common ground, and sometimes, perhaps, it's hard to find.

Another criticism concerns the appropriateness of an environment department being actively concerned in managing the water resource. Can it properly monitor the environmental effects of its own management decisions?

Melnychuk says he has "no good answer" to the question of where water resource management responsibility should lie.

"I suppose the water resource component of Alberta Environment could possibly be in Alberta Energy and Natural Resources, as for example public lands is," he said.

"That was something that was suggested by the Environment Council of Alberta in one of its reports . . . But that is a political decision.

"There may be some disadvantage in having a resource as important as water, which has an influence on everything, being part of a department very development-oriented such as Energy and Natural Resources. You can't compare water to coal or oil.

"On the other hand there may be some advantage to having it all in one super resource department."

Primus notes that a major intention in setting up a separate environment department was to join the water resources management component formerly in Alberta Agriculture with the section of Alberta Social Services and Community Health concerned with pollution control.

He adds that "it goes back to the basic question of what is the role of a department of environment."

Lauren Dale

Should the department have regulatory powers, or should it have an advocacy, "ombudsman" role without the teeth to make it really effective?

In the mean time, one of the department's many jobs *is* the management of water resources. And whatever the criticisms of past practices and decisions, there are suggestions both from inside and outside the

Alberta Government Photo

department of a broadening of outlook and some valuable work being done.

Carl Primus notes a trend away from strictly engineering solutions in many areas, flood plain management being one of them. There is also praise for some current projects — the stories on the South Saskatchewan basin study, on Page 27, and on flow forecasting, on Page 30, give some details.

But much remains to be done. As the 1972 summary report on water supply for the Saskatchewan-Nelson basin summarizes:

"What kind of society will develop in the future and what will be the extent of its water needs? Once it is known what is physically feasible, and environmentally acceptable, should development be encouraged where the water is, or should water be conveyed to where the development is? Should research be encouraged towards processes which use less water? What are the environmental values that should be preserved or enhanced during the development process? Before answers to these questions can be found many conflicts in water management must be resolved."

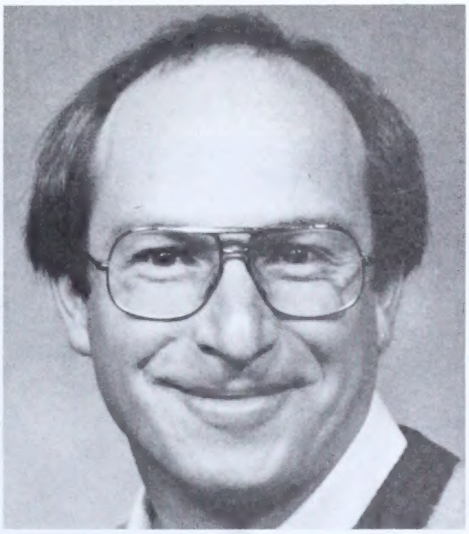
Gillian Sniatynski is the freelance editor of this magazine.

The February-March issue of *Environment Views* included a tabular guide to some of Alberta's hazardous wastes. The information it contained was attributed to the consulting firm Hu Harries and Associates Ltd., which had published the guide in a government-funded report on the economics of special waste management in December, 1979. In fact the original source of the information was a confidential report by the consulting firm W.L. Wardrop and Associates Ltd. for Kinetic Contaminants Canada Ltd.

VIEWPOINT

Peter Boothroyd:

Robbing Peter to pay Paul is poor planning.



Water is essential to life. Humans consume it directly, need it for agriculture and fishing, use it to generate heat and power, combine it with other materials to make useful products, keep themselves and their possessions clean with it, travel and transport their goods on it, mark their borders with it, like to look at it, play on, in or near it, and usually appreciate the wildlife that also depends on it. The demands placed on limited water supplies can be intense.

In the United States, the demand has been so strong in some areas that bodies of water are literally being soaked up. The Colorado River, once navigable for 300 kilometres from the ocean, now becomes a trickle and evaporates in the desert before it reaches the sea. Vast irrigation areas have had to be abandoned in Texas because the cost of pumping declining groundwater has become uneconomical. A few years ago, a river in Ohio became so heavily used as a dump for pollutants that it caught fire and burned.

In Alberta, a growing demand for irrigation water in the south threatens soon to exceed supply, and water scarcity is setting limits to the growth of some towns in the east central portion. The coal industry will soon require large amounts of water for feedstock to produce synthetic natural gas and to transport coal through slurry pipelines to the East. To meet these demands, government leaders have proposed diverting water from the large northward-flowing rivers to the southern basins. Nationalists keep warning that there might be American pressure to move the water even further south.

In addition to competition for water as such, there are also disputes over how to manage water courses. Ten years ago, Indians and conservationists were fighting the effects of British Columbia's W.A.C. Bennett Dam on Alberta's Peace-Athabasca Delta area. Recently, Alberta farmers have battled the government over a Red Deer River dam for industry, and have battled each other over Oldman River dams for irrigation and over flood control measures along the Paddle. Tomorrow there may be disputes over the impacts of Alberta's own hydro-electric dams on the Peace and Slave Rivers.

Conflict over water management is growing in Alberta. How should we handle this conflict? Some time ago, we recognized the necessity of controlling water usage. To do otherwise would lead to intolerable pollution or lack of water for downstream communities.

Our first response to the need to regulate competing demands was to permit them on a first-come, first-served basis. Then as competition grew more intense we sought solutions in construction projects, especially dams, to provide storage facilities to cover low flow periods. The technology that allowed us to manage water supply with large construction projects also allowed us to meet other needs: flood control, hydro-electricity generation and recreation. Thus new demands for water use were added to the old demands.

Then just about a decade ago, people who because of these projects lost their homes, or their livelihood as trappers or farmers, or their fishing spots or their favorite retreats started to complain. The voices of these innocent bystanders were added to those of the already competing direct users in the water resources management debate.

We are beginning to realize that often we have met demands for water by robbing Peter to pay Paul. This reactive approach to planning, that accommodates interests as each in turn expresses its demands, is becoming increasingly unsatisfactory. It gives the edge to the most powerful and articulate and those first wanting change, but not necessarily to those contributing most to society, or the most needy, or the most far-sighted. Should large industries, hydro companies, irrigation associations, provincial authorities and the present generation automatically have precedence over individual farmers, small communities, Indian bands, nature lovers, fishermen, wildlife and future generations?

If not, a new comprehensive approach to planning and managing water resources needs to be taken — one that involves looking at all actual and potential interests simultaneously and openly judging among them using fair criteria. We have evolved the technique of impact assessment to try to even the odds in the current reactive approach, but this is only a partial solution — it is not always effective in countering well advanced plans backed by powerful interests. Despite its limitations, impact assessment shows us how apparently simple problems are in fact complex, and how planning for one interest will always affect others. Therefore impact assessment's major contribution may be to advise us to replace reactive planning with comprehensive planning.

The development of comprehensive planning will be the challenge facing water resources planners in the '80s. If that challenge is met, future generations will thank us.

Peter Boothroyd is a consultant on impact assessment whose work has involved him, among other things, in the Oldman River Basin studies. He also teaches at the University of Calgary's faculty of social welfare and at the University of British Columbia's school of community and regional planning.

Between The Guidelines

Government policy is based on the fact
that water must be available when it's needed most.

The following is an edited excerpt of an Environment Views interview with Peter Melnychuk, Alberta Environment's assistant deputy minister for environmental engineering support services, and Carl Primus, head of the department's planning division.

Lauren Dale

Peter Melnychuk

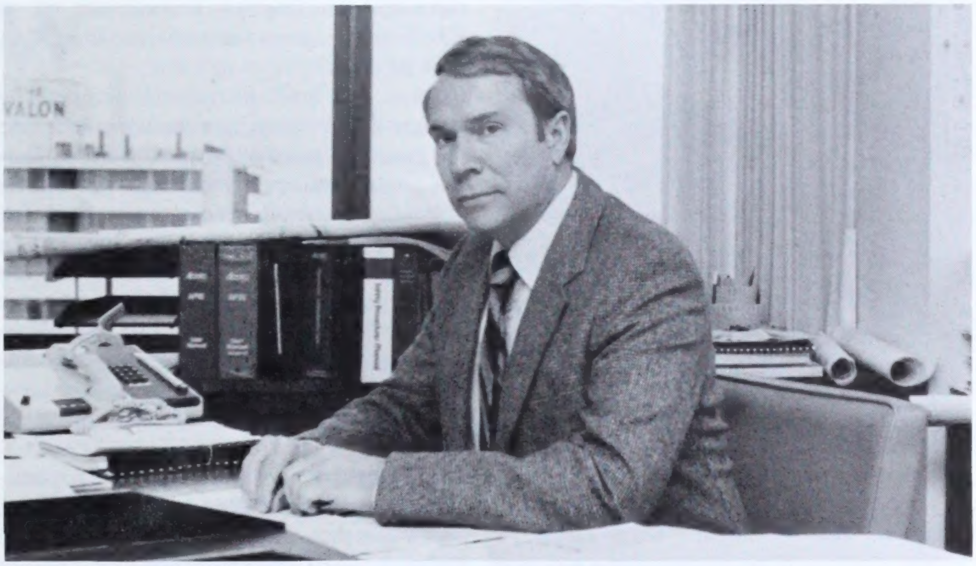
EV: What are some water management problems specific to Alberta?

Melnychuk: We have many water management problems, but we always start with our basic one — that is the problem of seasonal variation in flows in our rivers and streams. In my view this problem is unique to the province because of our geographic location relative to the the Eastern Slopes. If you look at a profile of the rivers as they come from the mountains and watersheds and as they cross Alberta and Saskatchewan and Manitoba, you find that Alberta's river gradients are very steep, relatively speaking. Add to this the type of climatic conditions we have in the spring, and the result is a very high peaking flow for a very short period of time in the spring. So that much of the water from the Eastern Slopes runs off very quickly through Alberta. In order for Alberta to utilize its share of the water, some artificial regulation of the flow needs to be implemented. Manitoba and Saskatchewan on the other hand have almost a natural regulation because their gradients are much flatter. We don't have such natural regulation, so in that respect some of our water management programs have to recognize these unique natural conditions. For this reason not all water management programs or philosophies can be the same, even between provinces. Therefore to ensure that Alberta can in fact utilize its share of the water, some form of regulation is required. Of course we can't use the water, nor do we really need it for the six weeks in early spring when we have peak flows. When we do need it, in summer and in fall, we don't have it. Alberta has almost all of the irrigation in Canada, in excess of one million acres. Irrigation is a very high consumer of water. So we need to implement some kind of man-made regulation on our streams, whether it is on-stream or off-stream storage or a combination of both, particularly in southern Alberta. So that is a basic water management problem that we have always had and we always will have. And that is one that needs to be dealt with now, not 20 years from now or 50 years from now. It needs to be dealt with now because that seasonal variation in flow is causing problems. To some degree we are dealing with it, by, for example, a regulation dam on the Red Deer. We have some regulation capability on the Bow River, achieved through Calgary Power's reservoirs. We have no regulation on the Oldman and studies and plans are under way to try to achieve some form of storage.

EV: Alberta Environment's statement of basic principles in water resource management says: "The philosophy of water management is based on: better use of available water resources; augmentation of available water supplies, where necessary; reduction of consumption." In practice, what does this mean?

Melnychuk: If we look to better uses of available water resources, we have to keep in mind that we work in concert with the department of agriculture, which involves the heaviest user of water — irrigation. I keep referring to irrigation because from a consumptive point of view that is our major user of water. And there are many ways in which both departments are not only cooperating but are providing technical expertise and funds for more efficient use of water in irrigation. That is done in a variety of ways. One is the manner in which the farmer actually puts the water on the land. Agriculture provides an extension program for farmers. This is to prevent over-irrigating and therefore wasting water. Putting on too much water not only wastes water but can damage land by salinization. We have funding programs that are available to irrigation districts for the rehabilitation of water distribution systems, for the rehabilitation of main canals. The department of course encourages the metering of water in all urban areas. The only city in Alberta that is not fully metered at the present time is Calgary, and the department is making some moves in that connection!

Primus: Better use of available water supplies, I think, would also apply, not just to quantity, but also the quality aspect. A good percentage of our acts and regulations are aimed in that direction — allowing the water



Lauren Dale

Carl Primus

to be used but requiring it to be returned in a condition that is not detrimental to downstream users.

Melnychuk: On the augmentation of water supplies, of course we try to capture our share of the water, as I explained. In order for the water to be available you have to have it for the time that you need to use it. With respect to reduction of consumption, we do not have anything specific in that regard, in terms of an operational program.

Primus: No, it's more of an encouragement. Under the Clean Water Act and other acts, some industries, in water-short areas, may perhaps be encouraged not to use cooling water, for example, but to develop other technologies and substitute other applications for the water.

Melnychuk: There is also the point, under the Clean Water Act, that heavy industrial users are encouraged to recycle as much as possible, in order to get the permits to construct their plants — which they have to get from Alberta Environment. Other than that we have no specific programs.

EV: What are some of the problems associated with water licensing, and the possible over-allocation of some streams?

Melnychuk: The basic principle is that the water belongs to the province; the individual can't acquire ownership of the water, he can only acquire the right to use it. Many of our streams have very large flows for very short periods of time, and the individual who is on such a stream wonders why he can't have a licence to use that water. The difficulty is of course that late in the summer or in the fall, there is no water in that stream. We have to treat each application for a water licence on its own merits, so there is a preferential use of water provided in the Water Resources Act. There are some streams in southern Alberta that may be approaching the full allocation situation. But what does "full allocation" mean? It may be full allocation for the stream in its natural condition — but if we were to regulate that stream it would be far from fully allocated. This is the difficulty — if our streams were naturally regulated we would not have any streams that were approaching full allocation. But we are approaching full allocation on those streams that are not regulated.

Primus: I think the challenge of licensing is to attempt to allocate water on a rational basis. We are in a free enterprise system where an individual can come to the department and say, I want to use water under the Act for this purpose. The date of the licence becomes another factor in his right to use water. It isn't possible to completely rationalize use on a stream where different people have different dates on their licences; if downstream reaches happen to be appropriated first, then in theory the water has to pass everybody upstream to make sure the downstream user who has got first licensing date gets his use. We are not proposing to go to a central planned approach where we completely rationalize all the licensing. It is still a free enterprise system so there are some inconsistencies.

EV: The Water Resources Act recognizes the importance of water for human consumption, for food production, for industrial use, and other uses, in that order. "Other uses" incorporate such interest groups as recreation and wildlife. Does the Act's preferential use system create conflicts for planners?

Primus: The priority concept hasn't really been tested. It is rather a theoretical situation at this point in time. It has come to the point where it will be tested on water-short streams, and the Act allows the minister either to reserve unallocated water for the future, or to license water for instream use. We are wrestling with trying to define what minimum flows we should be allocating for instream users — in essence the "other uses" — if it's desirable to do so, to maintain a fishery, for aesthetics, and so on. You have to balance that against pressures from those who want to withdraw water for consumptive use. To a planner the challenge now would be to define what are those acceptable minimum flows to maintain streams at an acceptable level for other uses without overly restricting the uses in the (Act's) ranking.

Melnychuk: The point is that the (preferential use system) is applied in an emergency situation. It is not being applied in the normal course of an application. It is the time of application that is important.

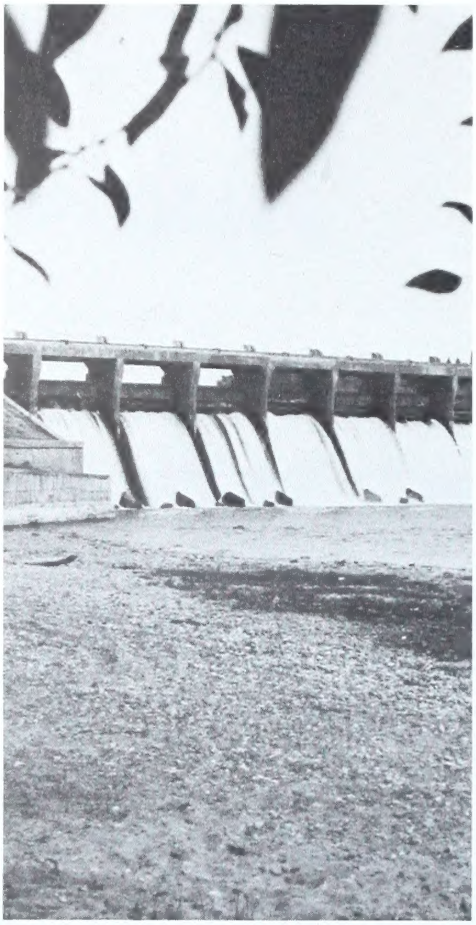
EV: How much effect does planning in water resource management have on political decisions about major projects?

Primus: Our approach as planners is that our function is to make information available, to provide a framework within which decisions can be made. We don't presuppose the decisions, that is not our function. We assume that the better the information we provide, the better informed the decision will be. The political process where the decision is actually made involves *all* the information that as technical planners we don't have. And every major resource allocation decision, every capital investment decision — it's ultimately the political process that makes that decision. If you can't accept that as a planner, you shouldn't be in planning.

Melnychuk: If there is an impression out there that somehow these decisions are made by the politicians in a back room somewhere, that impression is wrong, because they are not made that way. Someone has to put together a report that goes forward, and maybe that report gets modified because there are other factors operating which this department or our planners could not be aware of. But that initial report that goes up for decision-making is created *here*, and generally has the benefit of extensive study and public hearings.

EV: A recent case where the political process seemed to have bypassed the planners was the discussion about interbasin transfer which emanated from a committee then chaired by transportation minister Henry Kroeger.

Melnychuk: Probably the unfortunate thing is the manner in which the committee evolved. In my view there was no committee until the Minister of the Environment established one by ministerial order which was gazetted and made public a few weeks ago. Prior to that no committee existed officially. There was a group of people — interested people, and very knowledgeable and respected people — that got together and started talking about long-term planning of water in the province. Now there is an official committee which has terms of reference and reports to the Minister of Environment.



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Primus: I would like to take that a step further. In the department you have to work within the given guidelines. There are established policies. The development of *new* policies is very sensitive. Policies can be generated internally and go up through channels and be tested, or they can be generated outside. The question that the advisory committee is looking at is a policy question. Currently as a planner, I am working under policies which consider interbasin transfer as a last resort — it is not a management option that we have. If as a result of this review of the policy there is a policy change, if the decision is that interbasin transfer would be advantageous to the province, then that option becomes part of the overall management concept.

EV: Multi-purpose use is a part of current department philosophy. How realistic is it to talk about multi-purpose planning? Is such planning really possible?

Primus: You are getting caught in semantics and terminology. Originally, projects were built for one purpose: a hydro dam was to generate power; a water supply reservoir for a town was a water supply, period. Just because the reservoir was there, other people tended to want to make use of it. So you got almost involuntary use of the reservoir. Now the idea is that when you are building a facility, you are building it for a primary reason; but you can also perhaps use it for two or three other purposes without compromising that primary use.

EV: That becomes the question, then. Can that be done?

Primus: Yes, multi-purpose facilities can be designed. However, you can't *optimize* one purpose and have multi-purpose use. That is a contradiction. For example, you put a reservoir in for hydro-electricity, and if it serves only that purpose, you just let the water go, you don't care about how the water fluctuates and what happens downstream. As soon as you start to compromise, then you haven't got optimized power production. You can't optimize and have multi-purpose use — it's always a trade-off situation.

Melnychuk: It is still our policy, particularly where there are department funds going into a project, to attempt to get as many benefits out of the project as possible . . . And if you want to talk about dams then look at the Dickson Dam at Red Deer that we are building now. We are making sure that the reservoir is capable of guaranteeing a base flow in the river — that is the dam's purpose and it will do that. We are looking at designing it in such a manner that basically the reservoir level will be stable during the recreation season, and that will be a fact. We will maximize the recreational benefits out of it. We are designing it in a manner that hydro power *can* be produced, but produced without influencing the other two primary (purposes) . . . We are designing it in terms of spillways and operational capability to dampen a flood that might be generated in the watershed so that we will provide as much flood protection as possible, again without jeopardizing the primary function. We will reduce the amount of river erosion downstream of the dam by taking the peak off the flood flow, which is when most of the erosion and therefore the silt and the degradation of the stream occurs. So I don't want you to leave with the idea that we have a single-purpose policy — because the Red Deer dam is a good example. And it is one that is actually being applied, it is not something we are just thinking about.

Jim Neaves

Too Much, Or Too Little

Five farmers discuss water management problems and solutions.

Water is a primary agricultural necessity. But there are times when too much or too little can be disastrous.

Adequate moisture is needed to germinate seed in late spring and sufficient rainfall is needed throughout the growing season to ensure a properly developed crop. Too much rain can drown newly-seeded areas and erode valuable topsoil. Animals need water to maintain proper growth rates; severe drought can result in cows with ribs protruding through emaciated frames.

Water management problems, which can be costly, have affected farmers in all areas of Alberta.

Leonard Haney, who has a large farm eight kilometres east of Picture Butte north of Lethbridge, depends on water from the Oldman River for irrigation and his problems have been man-made. Kenneth Stafford, who farms 10 quarters about 16 kilometres northwest of Athabasca, has ambitious plans to use the abundant flow from the Athabasca River to provide water for a feedlot now under construction, which will accommodate 5,000 head of cattle.

Cecil Flake, who farms 192 hectares 24 kilometres west of Penhold near Red Deer, was not able to use all his land for production because some of it remained under water all year. His story is one of co-operation with neighbors and local government to complete a drainage project which has increased his arable land base.

Bert Jorgenson, a teacher who in the 1940s turned to farming just south of New Brigden in southeastern Alberta near the Saskatchewan border, has gently rolling land. He has spent large amounts of money and time to get sufficient water while at the same time trying to solve the problem of the many small potholes on his 2,200 hectares.

In the northwest, Frank Podruzny was able to solve his own farm's water needs fairly soon after he moved to a location just north of Wanham, north of Grande Prairie, in 1947.

Cecil Flake (above, left) with some of the neighbors who co-operated on a local drainage project

The project's river outlet (below)

Andrew Vaughan

He has become an expert on water-related problems throughout the large area and has worked hard to solve soil erosion problems created by forest clearing, oil exploration projects, highway and railway construction.

Haney's dryland farming has been helped by irrigation from the Oldman River. But needed water was cut off during the critical growing season in 1977 and again last year. Residents of the Peigan Reserve claim ownership of the riverbed running through the reserve and closed the irrigation system's headgates in a dispute over compensation. The ownership question remains before the courts.

Haney said the major problem is not knowing if or when the water supply will be stopped. Although rainfall can help, the lack of water can reduce yields of specialty crops.

"We had a dry summer last year and there is little moisture reserve in the soil," he said. "We have enough to get germination but a lack of water this summer could be serious."

However, even a resolution of the ownership problem will still leave concerns about adequate storage on the river.

"When it is settled, we'll be able to enlarge the headworks to improve the system of moving more water to Kehoe Lake which is used as a storage facility, and some time we'll need additional storage upstream on the river." A strong advocate of irrigation, Haney says its use can result in double the production from each acre and can quadruple the production on each quarter-section of land.

Flake, who grows grains, hogs and cattle, co-operated with his neighbors to get the County of Red Deer to fund 50 per cent of the construction of an 8.8-kilometre-long drainage ditch into the Medicine River.

Completed last year in six weeks at a cost estimated at $40,000, the ditch will allow "many more acres in the area to be put into production," he said.

With land in the area now selling between $1,200 and $2,000 an acre, the farmers

Flake and the drainage ditch (right).

Andrew Vaughan

considered their expenditure on the project worthwhile. "If we each only reclaimed one acre as arable land, the economic advantage is evident," Flake said. He described the co-operation from the County and Alberta Environment's water resources management division, through which the needed heavy earth-moving equipment was contracted, as "excellent."

The ditch, 1.2 metres wide at the base, 4.8 metres wide at the top and about 1.2 metres deep, empties directly into the river.

Podruzny, who grows grains and rapeseed on 400 hectares, is pleased at the cooperation evident between various provincial government departments in tackling water-related problems in northwest Alberta.

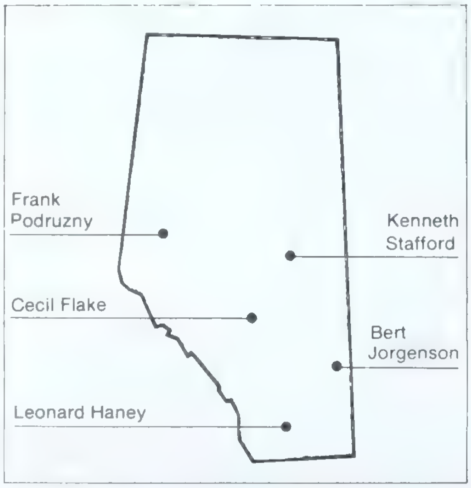
A participant in the presentation of many briefs about water problems, he says the piecemeal approach of every farmer trying to solve his own drainage and other problems usually creates more problems than it solves.

Podruzny's concern at first was soil erosion; and now it's drainage. He says local farmers are trying to correct problems initiated years ago when the area was opened up to agriculture and there was no guidance about drainage.

Podruzny says an overall plan for drainage in the area should be completed this year. He believes there should be a master drainage plan for both the Peace and Smoky river basins.

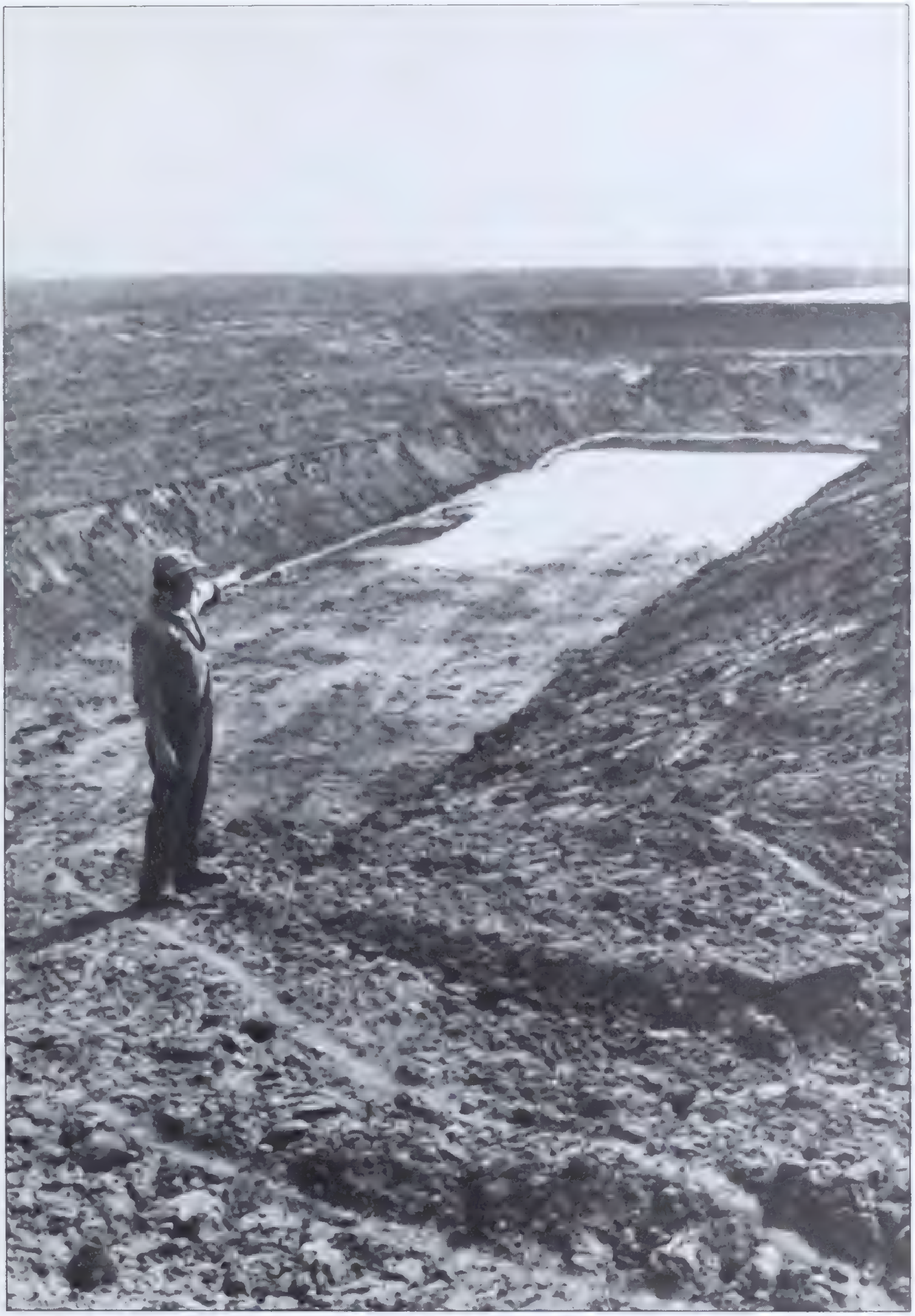
Stafford, a third-generation farmer on the same land, says he expects no problem in obtaining a permit from Alberta Environment to pump 4½ million gallons (some 21½ million litres) from the Athabasca River into his huge dugout. From the dugout, which is 121 metres long, 30 metres wide and 6.7 metres deep, a gravity system will move water to 36 feedlot pens.

Stafford, who estimates the system will cost about $90,000, says the alternative was wells up to 76 metres deep. With present drilling costs and the uncertainty of hitting an adequate supply, he said he was further ahead economically to adopt the pumping system. A huge tractor-driven portable pump is expected to fill the main dugout each spring and fall.



Stafford has had up to 1,400 animals at his operation and they have been watered out of one well, 65 metres deep. It is the second such well; the first was lost in what was suspected to be a ground shift at about the 33-metre level. Stafford says he will need the production from the equivalent of 1,200 hectares to feed his animals. He is considering making the huge dugout perform double duty by also providing water to irrigate land for forage production.

He says he received "valuable assistance" from local district agriculturalist Gary Berger in designing the feedlot, which he



Kenneth Stafford and the dugout
he hopes to fill from the Athabasca River (left)

Andrew Budgar

hopes to have in operation later this year. The huge banked up earth walls of the dugout will become the walls of adjacent silage pits.

"Our first plan was to have smaller dugouts at several locations, but the river certainly made it easier to provide the large volume of water we need," he said.

Bert Jorgenson's mixed grain, cattle and hog farm is situated on rolling terrain in the Oyen district and providing water has cost him a lot of money.

"We've had a variety of wells, one of the better ones gave us 12 gallons (51.6 litres) a minute at the 20-foot (six-metre) level but it dropped to about two gallons last fall and it created a real emergency particularly as we needed it for our hog operation."

This required a new well to be dug last December. It was good for one month and then sand got into the system reducing the flow.

Jorgenson has not dismissed the idea that seismic explosions nearby had some effect on the well's flow. "We just don't know and maybe we never will," he said, adding that Alberta Environment had been told about the situation.

But his main concern is draining potholes to increase farm productivity. Having to skirt them creates many problems when working the fields; he wants to drain them into larger sloughs which would then be used as reservoirs.

In addition these potholes when they dry up are death traps for ducklings that become vulnerable to coyotes and foxes as they try to reach another body of water.

Larger bodies of water would be a more permanent home for the ducks; and the removal of the small potholes also would combat the alkalinity caused by the water's reaction on the soil.

"This alkali problem is getting worse in western Canada and the number of acres affected is growing rapidly," he said.

"By draining many potholes we'll help combat the spread and while we won't stop it, we can retard its advance substantially."

Jim Neaves is a farmer and freelance writer who lives near Athabasca

Gail Gravelines

In Peace Country, the issue's clear:

Drain The Water, Keep The Soil

Fly over the Peace River area most Alberta springtimes and you'll see mini-lakes, a metre or so deep, standing in the fertile farm fields of the province's homesteading region.

While farmers in the south struggle to channel water into their lands, the Peace River agricultural community faces the opposite problem — discovering ways of draining the pools of water with a minimum of soil erosion.

Of the many factors that contribute to the region's soil erosion problems, it is the character of the Peace River itself that results in the rapid water run-off that combs the topsoil off the fields. The "mighty Peace" rises in the Rocky Mountains of British Columbia, flowing east through the northern Alberta plains, cutting the prairie to a depth of 300 metres in places, and forming a valley three to eleven kilometres wide.

The gentle rivulets meandering from the farm fields to the river level soon pick up speed (energy, as the water resource managers say) tumbling over the steep slope of the land, picking up more water, more energy, and more soil on their natural rush to the river.

The erosion problem is compounded by the nature of the Peace River area soil —an impervious subsoil layer stops any water absorption into the depths of the land, while the topsoil is easily suspended in water making it most susceptible to run-off erosion.

But soil erosion is not a new problem for the Peace River region. Back in 1938, W.D. Albright of the Dominion experimental station at Beaverlodge outlined the problems that continue to plague the region today in a paper titled "The Menace of Water Erosion in the Peace."

So what's being done to save the soil of the region that still contains large areas to be cleared for farming? There are new, planned drainage practices, planned educational programs and community-governmental teams formed to combat the problem. But the final, lasting solutions will cost. And they'll cost a lot.

Jerry Nessman, administrator of Alberta Environment's Peace River water resources region, is a member of the Regional Action Committee on Erosion (RACE). The committee is made up of members from the provincial environment, municipal affairs, transportation, agriculture and energy and natural resources departments. A member of the Peace River Regional Planning Commission also sits on the RACE committee. In existence for over a year, RACE is attempting to secure Heritage Savings Trust Fund dollars to finance

Fieldworkers inspect an experimental submerged outlet — part of the Peace River drainage project.

more effective water erosion control.

Nessman estimates the region would require $30 million over the next 10 years to build drop structures in the ditches that now exist, to slacken the speed of the water — and hence its erosion potential — as it plunges across the fields to the Peace.

He attributes most soil erosion in the area to poor agricultural practices and to the uncontrolled development of ditches, both farming and road, in the area. The Peace country is a recent arrival in the agricultural settlement of the province, and Nessman says many homesteaders and new landowners clear the property and don't know which way the water flows.

Clearing the trees also removes some natural anti-erosion tools. Tree roots break through the impervious soil layer under the topsoil and allow water to drain down too. Once the trees go, the land is exposed to wind and water erosion. With no place to drain off, the water sits in pools and curtails the farmer's productivity.

Nessman advises farmers in the area to keep the creeks on their land "in grass," leaving the vegetation intact to thwart rampant soil erosion. Contour farming where slopes are deep, and maintaining trees in shelter belts, would also help prevent wind and water erosion.

Although a traditional Alberta spring would cause several Peace area farmers to call his office for aid and information in draining pools of water sitting on the land, Nessman says this year's "unusually little snowfall and little run-off" has prompted only one or two calls.

Alberta Agriculture engineer Ron Johnston agrees that most Peace country farmers deal with drainage problems when the situation is obvious — during the spring melt. But his department is continually looking for long-term drainage solutions. One attempt to solve the problem is the Peace River Drainage Project, started in 1978.

Johnston points to an aerial photograph taken of the Peace country during the exploratory stages of the project. Dark, circular spots, representing pools of water, dot the fields of farmer Ben Kurys' land. When the project began, plastic pipe, approximately 10 and 15 centimetres in diameter, was laid in the ground to channel the water to an outlet off the field. Holes, lined with gravel, were dug in the water-collecting land formations. The water was then drained through the gravel hole, to the plastic pipe and off the field. The pipe costs $1 a foot ($3.33 a metre). The cost of installing the plastic pipe in the quarter section? $10,000.

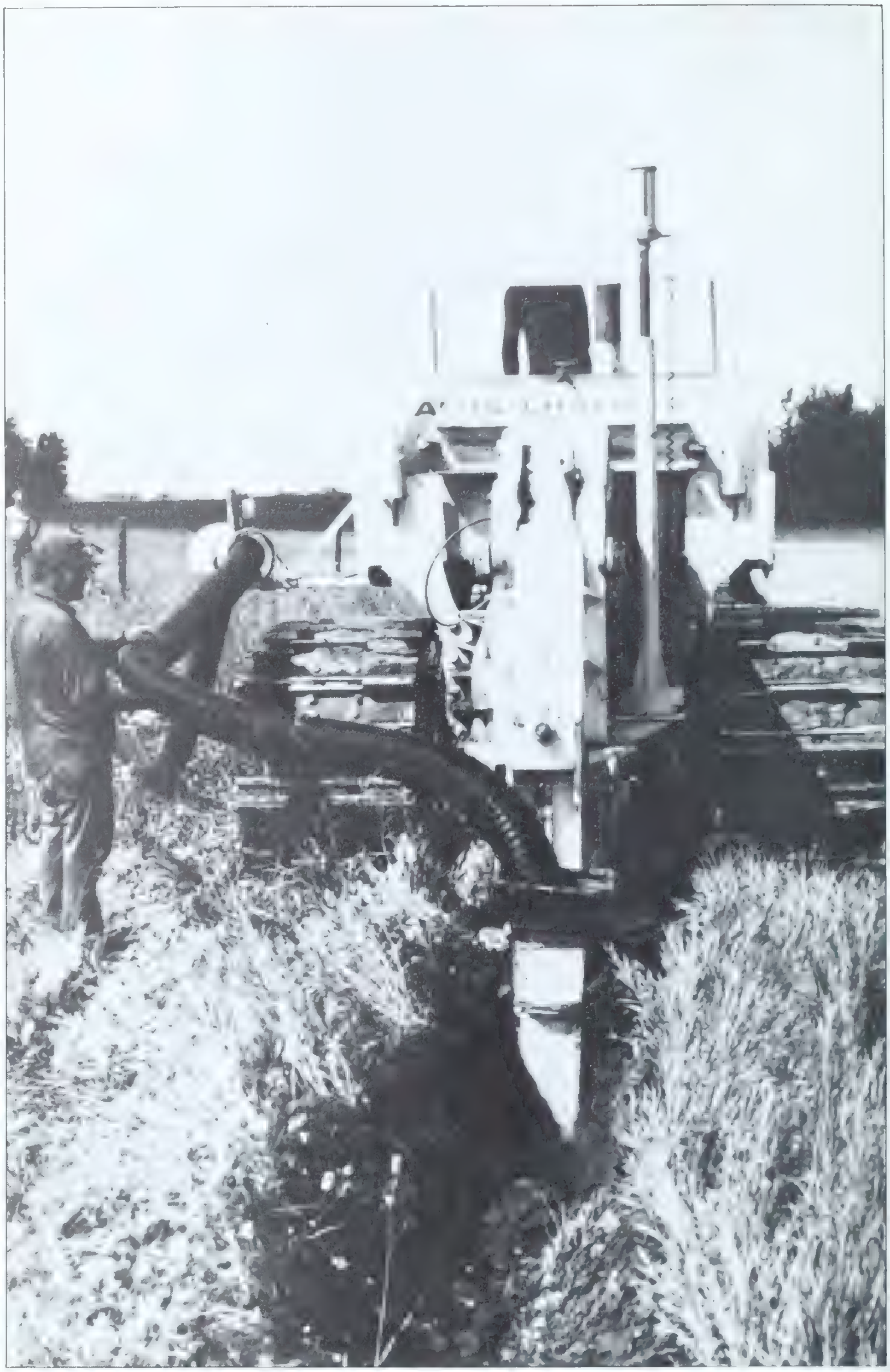
Johnston said the entire operation became an attraction for the other farmers in the area, whom he describes as "enthusiastic" about the project's potential. But they remain cautious because of the high costs involved. Farmer Kurys reclaimed some 20 hectares of farm land through the project. Because of its research nature, the costs of the project were split between the agriculture department and the operating farmer.

Ditches remain the most popular and economical drainage method. Johnston warns that farmers digging ditches should be careful to maintain a flat grade, using concrete structures to drop the water down, to cut the energy build-up of free-flowing run-off.

An Environment Council of Alberta publication — Information Paper No. 3, Public Hearings on Erosion of Land in Northwestern Alberta — provides a cost estimate of the capital loss of erosion.

Based on 1975 costs, the paper estimates sheet erosion of 1/16 inch (.15 centimetres) of topsoil of a quarter section of land would cost the farmer $500.

Farmers may gradually feel the economic pinch of erosion, but the fish species that make their home in the Peace country water-



Badger plow on the back of a tractor, used to insert drainage pipe into the ground.

ways experience the immediate effects of erosion. Fisheries biologist Roger Everett of Alberta Energy and Natural Resources fish and wildlife division says "disturbed discharge patterns" — whether flood, or on the other extreme drought — cause problems. But it's the effects of the soil sediment that most disturb fish spawning and living patterns.

At extremely high levels the sediment washed into the major waterways by runoff from the fields becomes highly abrasive, rubbing the life-supporting gills of the fish.

Fish spawning grounds are critical to the maintenance of a species, and an overabundance of sediment settling on the gravel in a waterway can inhibit the life cycles of the insects fish feed on. Some species — trout, for example — lay their eggs in gravel, their development depending on a constant wash of fresh water and oxygen. Sediment can suffocate the eggs; it can darken the water thus lowering the photosynthesis activity of the plants which replenish the water's oxygen supply; and it can cloud the water to the point where fish who feed by sight can't see.

Everett says the Peace country is home to pike, walleye, Arctic grailing and goldeye -- mostly sport fish with some walleye caught commercially. At worst, the sediment dumped into the waterways by soil erosion will reduce biological productivity, replacing the desirable sport fish species with the less desirable, hardy fish such as suckers (mullet).

With the grade of the land easing in the Edmonton area, water drainage problems are not as acute as in the Peace country. But they do exist. Larry Kuchmak of Alberta Environment's water resources management division says it's the "maverick" ditch digger that causes the problems. The standing water may be removed from his land, but is it causing problems on the acreage of the neighbor down the road?

Kuchmak says there is a constant effort to attend local county council meetings to outline the technical assistance his branch offers and to remind landowners in the area that a licence from the department is required before ditch construction.

The licensing is designed to aid the department in understanding the drainage diversions that take place in the area, in an effort to develop some planning in the overall water management of the region.

Kuchmak says surface drainage problems increase with increased development: paved and developed land doesn't absorb as much water as open farmland. With the development of more and more acreages in the Counties of Strathcona and Parkland, the department has developed a 50/50 cost sharing program for drainage projects with the counties.

As in the Peace area, ditches remain the favorite method of diverting water, Kuchmak says, with some plastic pipe, clay tile pipe and steel pipe being used to a lesser degree.

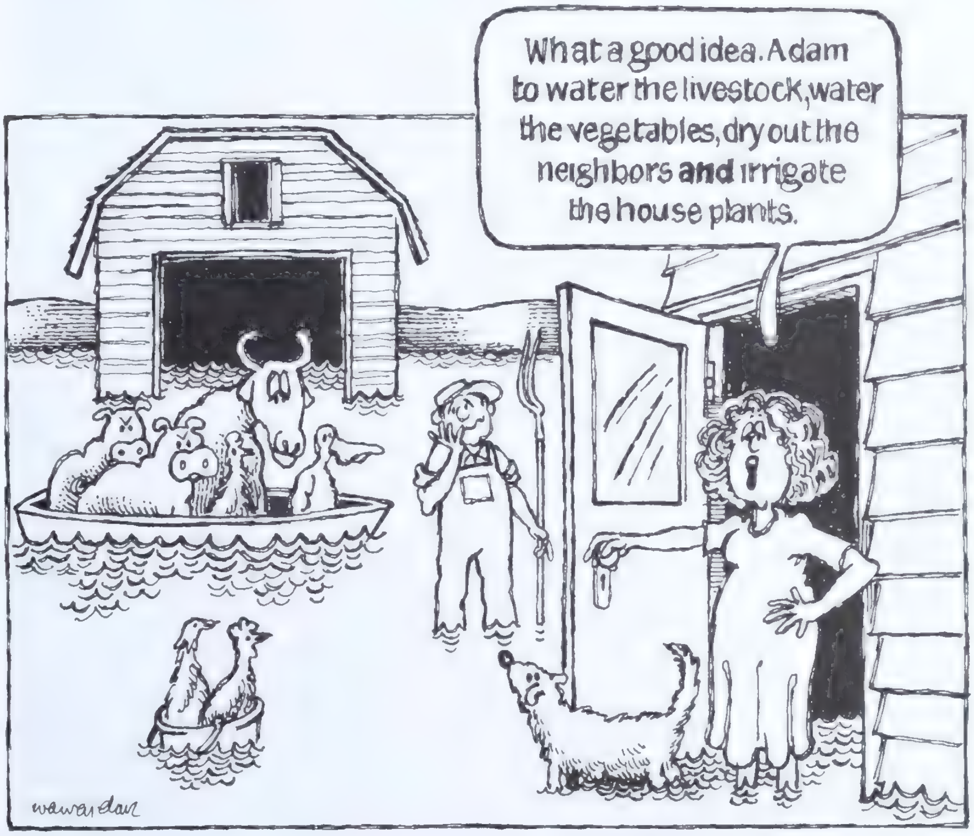
Again, the major drawback to the development and installation of long-term water drainage solutions is cost. But most experts agree: planned drainage techniques to protect Alberta's agricultural land will be worth it in the long run.

Gail Gravelines is a freelance writer living in Edmonton.

Sharon Adams

Do-It-Yourself Water Management

Irresponsible action may only make matters worse.


What a good idea. Adam to water the livestock, water the vegetables, dry out the neighbors and irrigate the house plants.
wawardan

The presence and availability of water are seldom exactly according to the farmer's specifications. As the preceding story indicates, if the land is not arid, it is too wet; the soil either allows for too much water to drain away, or not enough; the rivers and creeks are too far away, or too abundant too close at hand.

Professional solutions to some of the farmer's water management problems may be expensive or inappropriate. Sooner or later the time may come when he'll take matters into his own hands. Unless he acts responsibly, he may aggravate his own problem — or create one for someone else.

Problems arise from two general situations: either the farmer wants to increase the amount of land under cultivation by getting rid of some surplus water, or he decides to capture water for a particular use, like watering stock.

"Maybe he could see a low spot from a slough he wants to drain," says Andrew Livingstone of Alberta Agriculture's engineering and field services branch in Barrhead. "So he takes in a backhoe, drains the slough, and once it crosses his fence, forgets it."

But now the neighbor on the other side of the fence has a problem.

"If drainage leaves the boundaries of any quarter-section, the owner should have a licence. People don't realize that; they feel they own the water while it's on their land and can do what they want."

If the owner does get a licence to drain an area, he will also receive some advice for the best disposition of the water and warnings about some problems he may not have considered.

Sometimes there is no simple solution to a drainage problem and the licence has to be refused.

"Say a farmer has three small sloughs he wants to drain into one large slough. He may not realize that the land he's gaining could be less than the land he'll flood because the large slough will expand."

Simply draining the slough into a nearby watercourse, such as a creek, is sometimes an expensive solution.

"Maybe that creek only flowed one month a year and now it runs all year. That could be a problem for the guy downstream who used to drive across that creek when he worked his field and now he can't. It could start a round of suits."

The best way to approach draining, says Livingstone, is to get a licence, listen to the advice and do it the right way the first time.

A different kind of problem is produced by the farmer who sees an adequate supply of water nearby, but not located where he needs it. He may decide to divert a stream or build a dam or dugout without seeking the necessary approvals (and attendant advice) and subsequently adversely affect what happens downstream.

"If not done properly, a diversion could be big enough to dry up or reduce the flow to somebody downstream," says Livingstone.

Dugouts can cause their own problems.

"Usually a dugout is located right beside a creek or run-off channel (and connected by a ditch). Once the dugout is full, the ditch is backfilled and sometimes the creek fills up with silt."

There's also a danger of affecting water quality. The farmer may use herbicides to control the algae and weeds which find dugouts a perfect growing place. Sometimes the chemicals he uses to suppress them find their way into the water source — the creek or run-off channel or the groundwater itself.

If the dugout is needed to water stock, the runoff (which ends up in the nearest water system) may contain manure. If it's a fairly large operation, the barn may be located near a creek and the liquid wastes have to be got rid of — usually in a lagoon again placed near the water source.

A final concern is that the bottom of a dugout may be below the area water table so there's a potential for contamination of drinking water.

Ditches beside roadways in rural Alberta are often mistaken for something they're not — drainage systems.

Pools of water under culverts (left) or beaver dams (like the one below) may pose water management problems for farmers.

Andrew Vaughan

"In order to build a high, dry road, they excavate ditches alongside," says Livingstone. "Most people look at a road ditch as being some kind of drainage system, but they were put there to build a road, not for drainage."

Some farmers mistakenly try draining excess water into a road ditch only to find the ditch is higher than the field, and the water floods it.

Or the water sits in the road ditch for a long time, posing a health and safety problem.

Sometimes, roads can act as dams, blocking the natural area water drainage. Culverts are needed then — and they need to be well-maintained and not tampered with by nearby landowners who see them as a problem or a solution to one of their water problems.

Farming methods, too, can have adverse effects on water.

Barrhead's Paddle River, for instance, is prone to flooding. If the land is farmed to the water's edge, a flood can wash some of the topsoil away. This causes silt build-up problems and erosion of the stream banks.

"We recommend people maintain a 100-foot (30-metre) buffer strip to the river. The grass acts as a natural filter and keeps some of the herbicides and pesticides from flowing into the river, and it helps hold the silt during a flood," says Livingstone.

If the land is cultivated up to the river, "we get erosion and the banks sloughing in. If erosion keeps occurring, the stream gets wider and wider."

Good farming operation and thoughtful water management have a great deal to do with the quantity and quality of rural water.

"It's not uncommon to see a creek enter a farming area with good quality water and after it goes through four or five farming operations, come out raunchy," Livingstone observes.

But farmers are not the only rural land users who need to be concerned about water resources.

Developers and pipeline and transmission line companies also need to plan for minimum impact on the natural drainage system.

Brian Plesuk, a public participation co-ordinator for Alberta Environment, says people in an area have to "collectively make decisions about the land and water," not an easy process where there are a number of warring interests.

Developers who want to put up a streamside or lakeside permanent or vacation home project must give some thought to where the drinking water will come from and where the waste water will go.

If the development is in a farming area, the delicate balance of drainage and water supply has to be maintained if altercations are to be avoided.

"In rural Alberta, where farming is bread and butter, water is politics," says Plesuk. "If people would only look at what they're doing, a lot of problems would be avoided."

Sharon Adams is a journalist in Calgary

Jannie Stafford Edwards

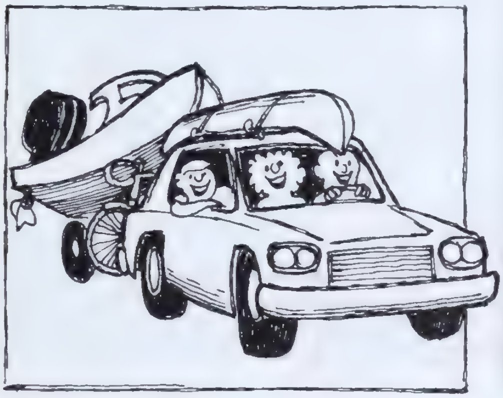
Water For Recreation

It takes some ingenuity to satisfy all users.

Summer's here at last. Time to pack up the kids and the hot dogs and head out to the lake. Time for a little fishing, a little swimming and sunbathing. Time for some quiet relaxation.

In Alberta, the reality is often very different: overcrowded beaches; fishermen complaining of water-skiers and motor boats scaring the fish away; private cottage owners and farmers upset about campers and picnickers trespassing and disturbing their property.

With eight per cent of Canada's population, Alberta has only 2.2 per cent of its total freshwater area. There are about 1,600 lakes in the province, but only about 45 of them are easily accessible to the general public. Most of the lakes suitable for recreation are in the Green Belt, a swath stretching from Cold Lake northwest to Lesser Slave Lake. In the southern and central regions of the province, where population concentrations are the highest, there are relatively few lakes.



And because there was little province-wide co-ordination of private developments on shorelands until the early seventies, some shores are almost entirely privately owned, often where lake shore access is most needed.

Chestermere Lake near Calgary is a case in point. The man-made lake, originally intended as an irrigation reservoir, is almost completely ringed with expensive lakeside estates which effectively cut off shore access to the public.

According to Peter Fearon, projects engineer for Alberta Environment's operations and maintenance branch, the government is moving towards a policy of preventing private development on reservoirs or controlled lakes. "We always use Chestermere as an example of what can go wrong," he says.

This policy trend is an acknowledgement of the fact that Albertans now are tending to make up for their lack of lakes by using irrigation and hydro reservoirs for water recreation. But access to the water is not the only problem they face.

In summer, when recreation demands are at their peak, water levels in the reservoirs are at their lowest due to agricultural demands. However, innovative schemes such as the new floating boat dock at St. Mary's reservoir in the Woolford Provincial Park may go a long way towards easing competing recreation and agricultural demands on southern reservoirs. The dock — "the first of its kind we've heard of in Canada," says Fearon — is constructed of styrofoam-injected rubber tires sandwiched between plywood and hinged to shore support structures. The dock floats up and down with water levels in the reservoir that can fluctuate as much as 7.7 metres in a season.

Opening up more water for recreation in the water-thirsty south is a challenge that has been picked up by regional and provincial authorities. A recently completed project in the Fish Creek Provincial Park south of Calgary is a man-made swimming lake which draws water from groundwater wells in the area and channels the water back to Fish Creek. Although it is man-made and managed by Alberta Recreation and Parks as a swimming pool, the small lake is designed to fit into the natural surroundings and even boasts sandy beaches.

According to Ron Hilton, regional services branch head of Alberta Environment's water resources management division, the southern towns of High River and Strathmore are investigating the possibilities of constructing similar man-made lakes for fishing and boating. Other southern communities may follow suit.

But opening up new water for recreation in the province is not the only challenge facing Albertans. In recent years, public consciousness has turned to the need for protecting and upgrading what limited water resources we already have.

At Gull Lake, a primarily recreational lake west of Lacombe, water levels had been steadily declining for 40 years or more. In the sixties, private cottage owners alarmed by dwindling water levels and yawning beaches requested government help in stabilizing the lake and raising its water levels.

Three years ago Alberta Environment's water resources management division initiated a scheme to divert water from the Blindman River to a pumping station, then allow it to flow by natural channels to the lake. Last year, a third pumping station was installed bringing the total volume of water diverted to Gull Lake so far to 16.4 million cubic metres.

A similar lake stabilization program is underway at Lac St. Cyr, near St. Paul. Residents of St. Paul, who use the lake as their major water supply as well as their main recreation outlet, became alarmed about water levels 2.7 metres below normal. In two pumping seasons (from October to December) so far, water has been diverted from the North Saskatchewan River to raise levels in the lake. Every two weeks during the open water season (from May to freeze-up) Alberta Environment tests

water in the lake and incoming water courses to determine whether there's more algae growth due to the river water input. So far, says Pat Mitchell, a limnologist (one who studies lakes) with the pollution control division, the results of the stabilization project are encouraging.

Another ongoing program to upgrade shorelands is Alberta Environment's site development program. The program is attempting to rehabilitate construction scars around dam sites. "Our mandate is to put environmental concerns first," says Peter Fearon. To accomplish this, an intensive grading and grassing and tree - and shrub-planting program has been undertaken to secure and beautify shores around dam sites. Native vegetation is being used wherever possible to achieve a natural effect, says Fearon. As an added recreation benefit to the public, picnic tables, firewood, boat launches and other amenities have been made available at some sites for day use. Where conditions are favorable, some reservoirs have been stocked with fish. These "pothole fisheries" are favorites with fishermen, who can thus fish in deep water by casting from dam structures.

In addition to making use of lakes and reservoirs for water recreation, Albertans are discovering that rivers and river shorelands also offer recreational possibilities. Edmonton and Calgary have undertaken extensive river shoreland facelifts: Edmonton's Capital City Park network crisscrosses the North Saskatchewan River shore area with bike and cross-country ski trails and picnic sites; and officials in Calgary are busy developing a similar network that will eventually extend from the headworks of the canal system on the Bow River 13 kilometres south to Chestermere Lake.

A major problem in developing rivers for recreational use is one of access, often limited (as with lake shores), by industrial and private ownership of land along the shore.

River recreation is difficult to police because of shoreline topography. Government officials have attempted to minimize safety risks to the public by placing warning signs and safety devices at strategic danger spots on rivers used by canoeists. Two canoeing accidents on the Bow River at Calgary prompted the formation in 1976 of an intergovernmental warning sign committee that recommended the placement of warning signs, and safety devices such as booms that distressed canoeists can grab to avoid dangerous downstream conditions.

The Alberta Wilderness Association, a private interest group, is committed to the protection of rivers for wildlife and recreation. Ron Hooper, a spokesman for the association, feels that input into water resources planning must include recreational demands and wildlife interests as well as industrial, economic and municipal demands. Hooper says the association wants to see legislation protecting wild rivers or river segments as wildlife habitats and for white water canoeing.

Jannie Stafford Edwards is a freelance writer living in Edmonton

Susan Mayse

Birds' Eye View

Ducks Unlimited is at work to save shrinking waterfowl habitats.

Waterfowl have firm ideas on where they want to breed, nest and raise their young: a quiet slough with a fringe of tall grass, surrounding woodland, plenty of insects and grain for food.

Farmers have equally firm ideas on how to grow grain: drain the sloughs to take advantage of their rich soil, cultivate and seed the whole area, and keep those blasted ducks out of the crops.

Waterfowl 0 - Farmers 1: for years that was the scoreboard in the competition to preserve waterfowl habitats — until the advent of Ducks Unlimited.

The private non-profit organization spans the North American continent — just as migrating wildfowl do — in an attempt to increase waterfowl resources, especially wetland and upland habitats.

"It's based on the theory that without a place to live, an organism can't survive," says Brett Calverley, habitat development biologist with Ducks Unlimited.

Supported mainly at first by avid duck hunters, the organization originated in the United States to increase numbers of ducks and other waterfowl threatened by dwindling wetland.

"Now the emphasis is shifting toward general-interest conservation groups - non-consumptive users such as birdwatchers," says Calverley. "The anti-hunting campaign in the United States has left its mark."

Direct and indirect waterfowl protection is the objective of the organization, which has no role in hunting — handled by the governments of Canada, the United States and Mexico under the shared Migratory Birds Act.

Ducks Unlimited takes direct action by legally tying up surface water in easement arrangements with government or landowners so it can't be drained, and by funding projects in co-operation with counties, municipalities or government departments.

Less directly, Ducks Unlimited staff lobby against major drainage projects which threaten wildfowl habitats. Verbal or documentary appeals (to Alberta Environment's water resources management division, for example) show the importance of the endangered habitat to wildfowl or to all wildlife.

"We want to inform the general public of what we can do to preserve habitats, and the value of the habitats to them."

Projects, says Calverley, are often too small or too large for Ducks Unlimited to take on. Technical advice is offered by the organization's biologists and engineers to enable other interest groups to handle small projects. Other projects, involving anywhere from five to 500 hectares of water, may become cost-sharing schemes with other agencies. Length of shoreline and the waterfowl population the shoreline can support are the deciding factors.

The draining and stabilization of Clairmont and Ferguson Lakes near Grande Prairie in 1978 was a typical Ducks Unlimited project with costs shared between the

Flax bale at Horsefly Lake near Taber, used for nesting by Canada geese (below, left).

Dam and rock spillway built by Ducks Unlimited across Etzikom Coulee near Foremost (below)

organization, Alberta Environment water resources management division and the County of Grande Prairie.

Clairmont Lake was prone to flooding, while Ferguson Lake, about two kilometres downstream on Bear Creek, was almost dry and badly overgrown.

Alberta Environment drew plans for structures to control water to both lakes, and invited Ducks Unlimited to share the cost. The group paid 87 per cent of the county's share or 44 per cent of the total — $230,000.

A small earthwork dam with a large water control structure restricts the flow of water to the upper lake, and a natural channel joining both lakes was improved to permit more water to reach the lower lake.

"Things worked out fairly well for Clairmont Lake waterfowl," Calverley says. "Drawing down the shoreline stimulated the growth of vegetation there, and improved the emergent vegetation such as rushes and grasses. These are used as nest cover, and give protection from bad weather and for flightless moulting birds. It also provided a quiet water area for submerged aquatic growth such as pondweeds." Invertebrates which are essential to the diet of female waterfowl during egg-laying were also encouraged.

"It all comes back to the vegetation aspect which is so important, and the ability to control vegetation."

By agreement Clairmont water levels could be lowered 30 centimetres; in a dry year that should prove sufficient to mantain high water levels on Ferguson Lake and drown its crowding cattails and bulrushes.

"The alternative is to go in mechanically and dig potholes and trenches."

Ducks Unlimited sometimes uses draglines to construct "level ditches" like meander channels, not for drainage but to allow more waterfowl breeding pairs to set up shoreline territory. But "we prefer to manipulate water levels."

Nesting islands are part of the continuing program for Ferguson Lake. Fifteen islands 30 metres by 50 metres with a one-metre elevation are now seeded to legumes giving waterfowl dense nest cover. At an anticipated three nests per island, it still provides safe nest areas for only about a third the potential waterfowl population of the lake.

"In future, we'll look towards establishing plots of nesting cover on uplands, which means making compensation to the farmers who own them."

Once vegetation near the lakes is increased about 400 nests, or twice the estimated natural potential, may be possible.

"What's good for ducks is good for other species. We would expect an increase in all other water-oriented species. One exception is Franklin gulls, since we would be opening

Saunders Lake near Leduc has been stabilized to protect wildfowl habitat (left).

up their dense-vegetation nesting area. We think they'll move closer to the shore and still feel safe."

Not everyone agrees. Stuart Loomis and Cheryl Bradley, biologists with Alberta Recreation and Parks, warn against enhancing habitats for some wildlife only.

"It's habitat manipulation for one kind of wildlife, with a clearcut purpose," says Loomis. "A lot of what they do is good, but it's a matter of caution. There's a danger in carrying it too far, and thinking that if a little water is good, a lot of water must be better still."

"Often Ducks Unlimited will drain a number of small sloughs to make one big one," Bradley says, "to the neglect of what other species may need, perhaps amphibians or insects."

Dr. Arleigh Laycock of the University of Alberta geography department also expresses mixed feelings.

"Ducks Unlimited is slightly biased in favour of creating waterfowl habitats – but the cost to farmers of raising ducks in the prairies is probably greater than all the subsidies to Ducks Unlimited." Ducks not only eat grain, but knock down what they don't eat.

He believes it's possible to reach a drainage compromise that permits effective farming yet protects wildlife areas, and sees this as the best approach. More dollar-value agricultural production is carried out in the United States in drained areas than in the whole of Canada's farmland, which "demonstrates that drainage can be a significant item." He cites recent government discouragement of drainage as an attitude that is "a little inflexible."

"We should be trying to reach a situation of controlled drainage rather than rapid flood. There can be significant land use and at the same time significant habitat use for waterfowl," says Laycock. "There is more and more emphasis on this attitude of compromise rather than entirely trying to meet the needs of one or the other."

Despite some reservations, Ducks Unlimited draws strong approval for its involvement in wildlife conservation.

"They do a lot of good things in terms of rehabilitating habitats around ponds," says Bradley.

"If their structures are well-planned and well-integrated into the environment," Laycock says, "they're no problem."

Loomis stresses the positive value of wetland preservation to the ecosystem as a whole. "Ducks Unlimited has played a primary role through its approach of making people aware of the role of water in the prairie environment, not only in terms of ducks but for their aesthetic value, and for providing humidity in what might otherwise be a dry area. Its work has an effect on the entire microclimate."

"In four years I've never heard a complaint that Ducks Unlimited alters natural systems to the point where it's not a conservationist organization," says Brett Calverley.

Ron Hilton, head of the regional services branch of Alberta Environment's water resources management division, says the agricultural community also benefits.

"The projects provide stock water from storage. This is particularly important in the special areas near Hanna where water is in short supply — Ducks Unlimited has provided a number of water storage facilities to hold spring runoff."

The organization's funding system is also noteworthy, he adds. Instead of taking government money for private projects, Ducks Unlimited applies private money to government projects. Most of the funds are still raised in the United States by the parent group, Ducks Unlimited Incorporated.

"For the Ribstone Creek project all funds were provided by the State of California —large corporations sometimes like to have a particular project ascribed to them. It's unusual, but I think it's a worthwhile endeavor in preserving habitats that might otherwise be destroyed."

Wildfowl 2 - Farmers 1? Not on your life. It's still a struggle.

"We're still losing wetland habitats faster than they're being created by Ducks Unlimited work," says Calverley. "We can't keep up. The continental population of wildfowl is beginning to suffer."

The organization's work has begun to embrace agricultural research, in hopes of offering farmers a capability for high food production without damaging habitats. Zero tillage with use of short-duration herbicides is one avenue.

"The pressures — of individual finances and the national economy — to increase the effectiveness of agriculture in Alberta makes it almost impossible for a farmer to not drain a slough."

Ducks Unlimited is hard at work, all the same, trying to make it possible.

Susan Mayse is a freelance writer living in Edmonton.

Maryhelen Vicars

Hydro Development: Some Pros And Cons

When the Alberta government announced this spring it had approved in principle the building of a thousand-megawatt hydroelectric dam at Dunvegan on the Peace River, local people were enthusiastic.

The reservoir created by the dam, while it would flood hundreds of hectares of bushland, could provide a habitat for fish and give the Peace area what it has lacked: a large recreational lake.

That's the view of Larry Chorney, town manager at Fairview, a small community close to Dunvegan. He says townspeople feel the reservoir will provide fishing and boating for locals, as well as giving the area's tourist industry a boost for many years to come.

Wally Peterson is the owner of a sports shop in Fairview. He agrees with Chorney that the proposed dam would be good for business, but as a fisherman and hunter, Peterson has some fears about the long-term environmental impact.

"The river valley from here (west) to the B.C. border is one large reserve for wildlife. With the surrounding land at the top of the banks all used for agriculture, the valley is the only area the animals have to live in anymore.

"The valley provides a feeding ground for deer and is one of the best black bear areas in the province."

Some of the land Peterson refers to will be covered by water if the Dunvegan dam is built, but a 1977 feasibility study undertaken by the Alberta Hydro Committee (with representatives from several government departments) found that critical winter ranges would not be flooded.

'It won't affect me, but what about future generations?'

The habitat lost to the reservoir would, however, reduce populations of moose, deer, bears and wolves slightly in proportion to the amount of land covered.

The feasibility study considered three alternatives: a high, medium and low dam at the site, with reservoirs sized in proportion. The low dam is the alternative the government approved in principle, asking for construction proposals from private industry.

The low Dunvegan dam would be 85 metres high and create a reservoir stretching about 100 kilometres to the B.C. border, and covering 96 square kilometres of river valley.

Bryan Kemper, head of the environmental impact assessment branch of Alberta Environment's planning division, explains that hydroelectric dams have heights of 30 metres or more. Water stored in the reservoirs is released to drop through turbines which generate electric power.

The energy originates with the force of the water as it drops, and as such is a completely renewable resource.

Theoretically, Kemper explains, the Peace could be dammed every few kilometres, with the water which did the work at the first dam flowing into the next, plunging through its turbines and then flowing to the next site.

If a dam is used to provide base-load power, a constant amount each day, there is little fluctuation in the level of the reservoir. If it is used for peak power there can be wide fluctuations as the gates are suddenly opened wider to increase the speed of the turbines, more water rushes through and the level in the reservoir is suddenly lowered.

Kemper says this can create bank stability problems, and reduce the reservoir's usefulness as a lake for recreation use.

"The banks are soaked with water, and if the level is suddenly drawn down the wet banks slump. This is ugly, it fills in the reservoir and people complain."

Wide variations in water level can take their toll in fish populations, too. Fish tend to spawn within a few metres of shore. If the level suddenly drops, Kemper says, the eggs could be destroyed when they are exposed to the air.

Peterson says the combination of the bank

Kananaskis hydro dam

slumping problem and the heavy load of silt carried by the Peace at all times is causing local concern.

"I don't know how long it will take before we've got a big lake of silt there. It's not something I fancy leaving for the later generations coming up. It won't affect me, but what about them?"

Carl Primus, director of Alberta Environment's planning division, says economics will determine how the dam is to be used and whether, as a consequence, a stable water level can be maintained.

Primus says hydro power is a "clean" source of electric power. In 1975, 10 per cent of Alberta's power was generated in hydro dams. By 1979, the proportion had dropped to seven per cent as new thermal plants began operating.

The other 93 per cent was generated in coal-fired thermal plants. Coal is a nonrenewable resource, with environmental problems involved in both mining and burning.

Primus says one reason the Alberta government has called for proposals at Dunvegan and begun feasibility studies at Mountain Rapids on the Slave River is that it favors the cleaner, renewable hydro power and wants to maintain at least a 1:10 ratio of hydro to coal.

Alberta's need for electric power, however generated, grows each year, as the population increases and the province becomes more industrialized.

The average growth in power demand is projected at 355 megawatts per year over the next 15 years. At a maximum capacity of 1,000 megawatts, the Dunvegan dam would meet the demand generated by only three years' growth.

The Dunvegan site is downriver from one of the largest hydroelectric projects in western Canada, the W.A.C. Bennett Dam. Its huge reservoir, Williston Lake, covers 1,650 square kilometres. The head of the dam is 182 metres high.

A dam of this size obviously has a tremendous impact on the environment. The huge reservoir, needed to ensure a regular flow of water through the massive turbines all year round, took several years to fill. During these years, the supply of water downriver was much reduced.

Special problems were created in the Peace-Athabasca Delta where annual floods maintained the delta wetlands, an important habitat for waterfowl, moose and muskrats and for spawning fish. When the flood was eliminated, the wetlands began to dry out and the whole complex was threatened.

The problems were largely solved in the early 1970s by blocking streams in the delta, blocking some of the spring runoff and maintaining acceptable water levels.

Dams built downstream of the major projects are called run of the river dams, and need much smaller reservoirs and consequently cause less impact on the environment. Water regulated at the main project flows at a predictable rate through downstream dams.

On the Peace River, the Bennett Dam is the "controller of the system", Kemper says, while Dunvegan, as a run of the river project, will just tap the energy from the water made available downstream.

The feasibility study of a site at Mountain Rapids on the Slave River just south of Fort Smith on the Alberta-N.W.T. border is now getting under way.

Officials were reluctant to talk about the impact this dam could have in northeast Alberta before the results are known of impact studies which have just begun and are projected to take two years.

It would be the first project on the Slave, and unlike the run of the river Dunvegan project, would involve a massive reservoir.

The reservoir, which would flood part of Wood Buffalo National Park, would affect two large wetland areas: the Peace-Athabasca Delta and the Slave Delta.

Kemper says the substantial commercial fishing industry in Lake Athabasca is also prompting the government to "move cautiously" on the Mountain Rapids proposal.

Fish habitat in the area could actually be improved, he says, as the dam would eliminate several substantial rapids which now act as a barrier to fish movement on the river.

There is at least one special environmental problem posed by the Mountain Rapids development, however.

At Pelican Rapids, there is an isolated colony of white pelicans nesting on an island in the middle of the river.

"This is one of the few nesting sites left in the province," Kemper says.

If the dam went ahead, it would be necessary to move the colony during construction, and eventually find a new home for it.

Maryhelen Vicars is a journalist in Edmonton

Elaine Park

Supply And Demand In The South Saskatchewan Basin

A new program will attempt to calculate both sides of the equation.

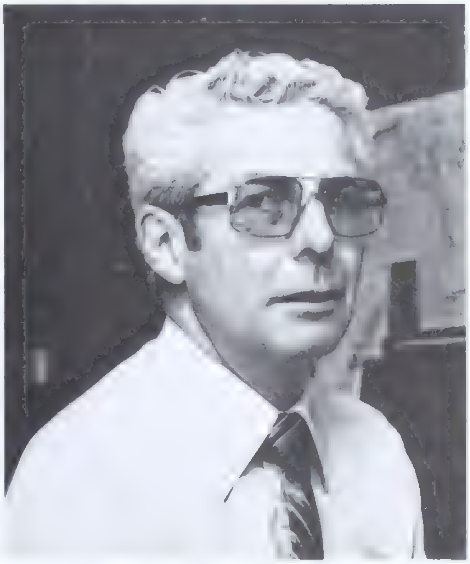
Water is one of southern Alberta's most precious resources. But there may soon be too many takers for the amount of water available, and Alberta Environment planners are proposing to intervene before a serious water shortfall occurs.

Nearly half the people in the province live in the South Saskatchewan river basin, an area of 143,000 square kilometres drained by the Red Deer, Oldman, Bow and South Saskatchewan Rivers. Today, water in the basin is flowing bountifully enough through five city water systems, thousands of farm irrigation pipes, several hydro-electric generating facilities, and lakes and streams that support fish and wildlife as well as human recreation.

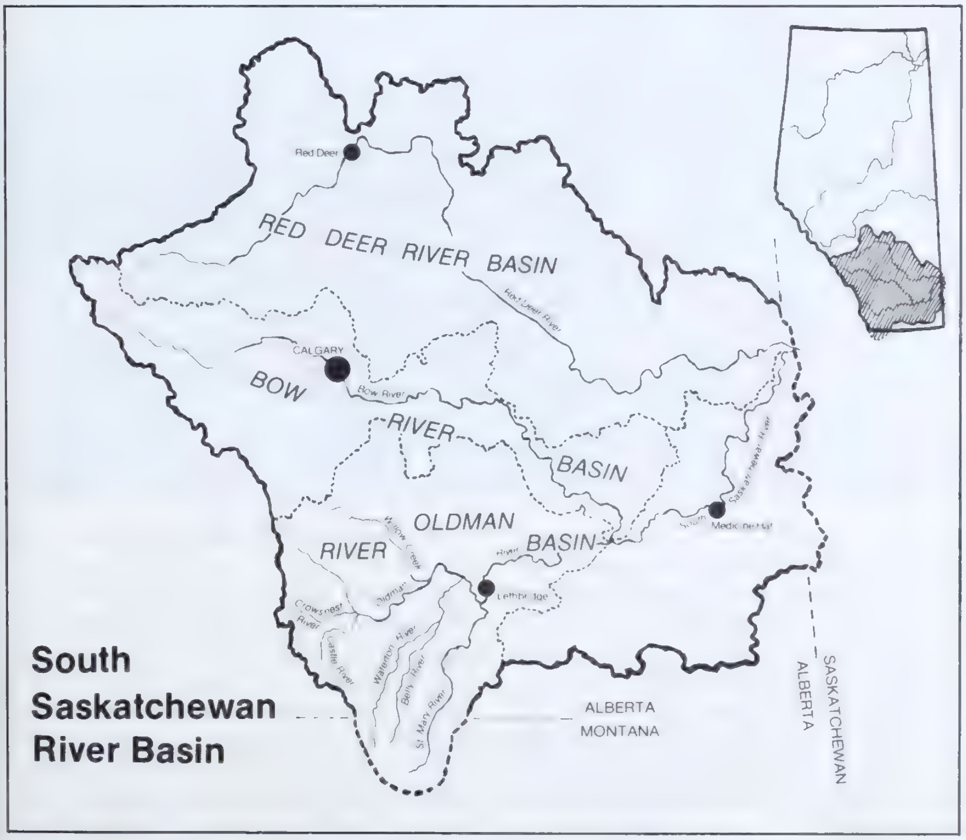
That water supply, however, is finite. Man can do little to create more water in the rivers than nature is already producing. Yet man's demands on the water are increasing all the time as the Alberta economy expands and more urban settlers, industries, and agricultural developers draw on the wet wealth. Recent flow regulation studies conducted on the Red Deer and Oldman Rivers showed a rapid growth in water demand, and water management planners pointed out an urgent need to look at water demand and supply throughout the southern region.

To answer that need, Bow River planner Jack Glenn has authored a proposal for a massive South Saskatchewan river basin planning program that is currently under consideration within Alberta Environment.

The proposal calls for assessment of all water supplies and all current demands on them in the basin, a forecast of probable future demand patterns, and formulation of a framework for coherent management and allocation of available water.



Jack Glenn



South Saskatchewan River Basin

Projected to take at least five years and to involve participation by the general public, special interest groups, and many provincial and federal government departments, the planning program will be one of the largest and most comprehensive ever handled by the department.

Only a large, all-embracing plan is worth doing, says Glenn. An ad hoc approach of looking at each waterway by itself and not considering the effect of different water management tactics on the whole interconnected system can only lead to over-allocation and user conflict, he warns.

"Historically, governments in Canada have relied on individual reports about individual rivers. These reports are static, outdated as soon as the ink is dry.

"The result of ad hoc studies has been that we have tended to go to the simple solution — to build another dam, for example. As long as the water supply has been adequate, the simple solutions have worked.

"But as soon as we begin running out of water — and I think we're approaching that point — we'll have to start looking at the whole complex situation and at alloca-

tion among different water users."

The basic mathematics of the situation are obvious and discouraging.

"Sure, water is a renewable resource. It fills the rivers year after year," says Glenn. "But each year there is only a finite amount of it while demand, on the other hand, is potentially infinite. In southern Alberta, demand has doubled in only the past 30 to 40 years."

There are four main constraints on management of water within the South Saskatchewan river basin: supply, which varies from year to year and season to season within a known range; demand, which comes mainly from the irrigation districts as the largest consumers; the Master Agreement on Apportionment, by which Alberta has agreed to leave about half of its South Saskatchewan flow for use by Saskatchewan and Manitoba; and government policies, which set guidelines for use, quality and quantity control of provincial waters.

These four factors taken together mean that much of the water flowing through southern Alberta is already spoken for. Any new demand, such as that created by possible industrial development in the Red Deer Valley or expanded irrigation in the Bow-Oldman basins, would set the scene for a political battle royal over water rights.

"Some planning framework is essential," says Glenn. "Because our current level of demand in the basin has — I suspect — outstretched our capacity of supply in a low-flow year, if a really dry period came along, we could be in much worse shape than we were in the thirties."

The expansion of irrigation has placed particular strains on the supply. The flow in the rivers is greatest in June and July, when a lot of water comes through very quickly. By building dams or diverting the spring run-off to natural storage reservoirs, it has been possible to manage the water and accommodate the needs of irrigation systems through the dry days of August.

But there are limits to storage. Of the three main source rivers, only the Red Deer does not yet have some form of flow regulation, and a dam on that flow is coming. The Bow and Oldman are already regulated by hydro-electric and irrigation installations. The province can't go on forever building dams.

"Today's financial costs of dam construction are exorbitant, and there are great social costs as well," comments Glenn. "We are getting to the point where we will just have to allocate water according to the perceived 'best use'."

Determining the "best use" will be a thorny job.

"It comes down to a choice of futures for the region," says Glenn. "For instance, if we want to allocate water according to strict economic efficiency, then maybe we should allow increased consumption along the Oldman and limit use along the Red Deer. If we want regional industrial development, however, maybe we will have to limit the Oldman consumption and allow

From young swimmers and many others, the demand for water continues to grow in the South Saskatchewan basin.

more water use along the Red Deer.'

Because the implications of the planning project are so broad, the first step will be compilation of a reliable far-reaching data base. Planners must be able to predict how much water will flow, when it will flow, and what its quality will be.

Measurement of the water is a complicated task.

"We're working with only 65 years of recorded data," says Glenn. "However, 65 years is pretty good compared to some other things. For example, our water quality data go back only 15 years. But we can't wait 100 years just to get more data."

The proposal suggests a four-phase development for the planning program. Phase one, now nearly complete, is the initial design of the program. Phase two, with a suggested completion date of April, 1981, involves an overview of water supply and use in the entire basin, with identification of trends in water use and the drainage system's sensitivity to these trends. Existing and potential problems of pollution and water balance will be noted, tentative policy recommendations will be developed, and priorities for management planning will be set. In phase three, from 1981 to 1985, the planning process as outlined in the proposal will go forward, with information being collected from as many useful sources as possible. Phase four will be the ongoing maintenance of the water management plan, with the data base and computer models being continually updated, water management being monitored, and the framework of the plan receiving periodic review.

All water users, from Calgary Power to sport fishermen, will be asked to state their water needs — how much they require, where and when they need it, and what quality is necessary. Both current and probable future requirements of each user group will be compiled, the demand package will be fed into the computer, and a mathematical supply-demand balance model will emerge.

Public participation in the planning process is an essential element. Dave Anderson, head of Alberta Environment's public participation branch, is preparing two main participation programs, one for the special interest groups like irrigation district representatives and environmental organizations, and one for the general public.

"The big challenge will be accessing all the people who just turn on their taps, expecting the water to be there," says Anderson.

"We have to increase people's awareness of the importance of water use planning, so we'll probably use a high-profile media campaign, school programs and public meetings.

"People will have to realize that our water will only stretch so far, and that water is the limiting factor in any future development of southern Alberta.

Elaine Park is a freelance writer living in Calgary

Susan Mayse

Tomorrow is already here, when it comes to

The Technology Of Flow Forecasting

Alberta's rivers rise in the Rocky Mountains, and spread across the province in a network of streams and creeks. On a map they look like veins and arteries, and they do much the same job. Agriculture, recreation, wildlife habitats and industry depend on a steady flow of water for their existence.

Dave Graham

Lauren Dale

Stream water can destroy as easily as it creates. A flood may drown livestock, wash out roads, cost millions in damage. A drought may reduce productive farmland to windblown dust. We haven't found ways to create running water in a dry year or evaporate a flood before it starts, but we can dam and divert water to control it, or at least stay out of its path. This means knowing everything possible about river water: where it's coming from, how much there is, and when it will arrive.

Flow forecasting uses constantly changing river levels, rainfall and other factors to regularly predict water flows.

"We're always on watch," says Dave Graham, an engineer with Alberta Environment's flow forecasting branch. "We've just been through spring runoff on the plains, and now we're waiting for summer runoff from the mountains."

A prime application is flood forecasting. The department's river forecast centre monitors precipitation and river height. It then uses computer simulation to chart out probable water levels for about 40 river basins (the drainage area of all the streams in a river system).

Most basins are monitored from early April to October, but "it depends on the river and the year." Raw data comes from three sources.

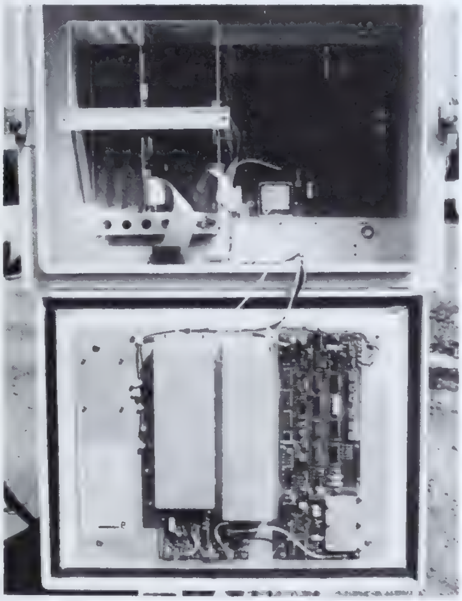
The federal Atmospheric Environment Service (AES) regularly releases precipitation figures, drawing on its volunteer "climatological network." The service also uses atmospheric data to provide daily and long-range forecasts — essentially the same information the television weatherperson passes on to you. In unusual situations, the forecast centre may personally phone AES volunteer observers.

"If we know rain is in an area and there's a potential for flooding, we'll talk to people directly to get a better idea of conditions, and when they might end."

The Alberta Forestry Service is a major data supplier. Its network of ranger stations, observers and fire lookout towers all report weather twice daily, at 7:30 a.m. and 1:30 p.m., with a few stations making an 8 p.m. report as well. The observation network stretches from the Crowsnest Pass to the Peace River, covering the East Slopes region of the river headwaters which is vital to streamflow prediction.

Alberta Environment's own telemetry network is the third source. Telemetry derives from Greek words meaning "distant" and "measurement", and this still gives a fair idea of the process. Hydrometric or

The Alberta river forecast centre (left)
Testing of "smart boxes" (right)



Lauren Dale

water-measuring stations take measurements, often using a float riding the water surface in a well sunk in a river bank —and transmit their information by several means for processing. The forecast centre still gathers some seasonal data on foot. Helicopters play a part, the telephone wires netting the province carry measurement information — and starting this year, four stations will report their observations by satellite.

Simplest of the telemetry devices is the Telemark. Hydrometric stations in each river basin are phoned on a regular schedule — usually once a day through the summer, but as often as once an hour in flood conditions.

"The Telemarks have been installed for years to measure water flow," says Wayne Krywolt, head of Alberta Environment's systems and computing branch. "They're hooked into the telephone lines and operated manually by someone dialling in the station, which sends back audible tones."

A station on the North Saskatchewan, for instance, might report a water level of 1.35 metres. The station transmits one beep — pause — three beeps — pause — five beeps. The person making the call notes the information by hand.

"It's telemetry in an earlier stage," says Krywolt.

About 75 per cent of the service's hydrometric stations are Telemarks, but not all are still manually operated. Approximately 60 per cent can be contacted automatically by computer. The measuring devices are the same — it's simply a matter of installing electronic equipment to permit a computer link, scheduling "interrogation" or data reporting, and programming the service's computers to place the calls and note the information.

Satellite communications is clearly the future of flow forecasting, but the Alberta river forecast centre isn't waiting for tomorrow. Part of a satellite-reporting device called a "smart box" sits on Dave Graham's windowsill, quietly soaking sunlight into its solar cells as it awaits installation in a location beyond the reach of telephone lines.

The white metal "smart boxes" or data collection platforms are themselves computerized. Taking measurements of river height, temperature, humidity and other factors through connected sensors, they store data on micro-chips and regularly transmit it skyward.

The "GOES" satellite to which they'll report is already up, stationary rather than orbiting. Its full name is "geostation environmental satellite system", and it's owned and operated by the National Environmental Satellite Service in the U.S. to transmit a variety of forecasting information for several agencies. Alberta Environment's smart boxes will transmit every three hours up to eight times a day in normal condi-

Lauren Dale

tions. Each platform has its own "window" or one-minute time slot for broadcasting, and originates the calls itself rather than waiting for a computer to make the connection. The streamflow data is retransmitted to a ground station in the eastern United States, and passed on to the forecast centre by a phone-line computer hookup.

The smart box in Dave Graham's office is destined for a site on Little Elbow Summit, west of Calgary.

"It goes in this summer after the snow is gone," says Graham. "The box will be mounted in a shelter, and we'll lay cement for a tower to take wind measurement about three metres above the forest cover. The transmitting antenna must also be above the trees."

Other satellite-reporting stations will be placed at Forget-Me-Not (also in the Elbow headwaters), in the Paddle River headwaters, and in the Red Deer River headwaters. All are remote areas without phone lines, so "they have a higher priority."

"I foresee that with reduced costs of computerization it will be feasible to automate a wider range of stations," says Wayne Krywolt. "With advances in communication, both ground-based and satellite, more stations will be accessible by some form of communications. The result will be better information on flows."

Information from Alberta Environment's telemetry network and other sources feeds the computer simulation to permit prediction of water levels. The simulation makes allowances for:

- time of year — runoff or other conditions;
- duration of storm — if three or four days, the flood peak is small;
- amount of precipitation;
- antecedent precipitation — previous rain or snowfall.

"We can compute what the flow will be, when its maximum water level will occur and how much water there will be," says Graham.

"Then we have to assess 'will it be harmful?' If it is likely we give out a high water warning."

Flood forecasting has repeatedly saved lives and property in Alberta. In a 1975 flood, a group of scouts and guides camping on the Oldman River was warned in time to prevent disaster, and a feedlot operator was able to save his cattle from drowning by getting them to high ground.

The Alberta river forecast centre keeps a list of people and agencies who must know about possible flooding: RCMP, Alberta Disaster Services, Alberta Research Council and several flood-prone towns including Cardston, Pincher Creek, Turner Valley, High River, Calgary, Peace River and Red Deer. The emergency call may come only one year in five, but allows time for evacuations, sandbagging or anything else that can prevent flood loss.

The centre's other public services use the same information to produce weekly river reports and canoeists' reports during the summer, and to advise operators of provincial reservoirs on special water needs or hazards. Every year from March to June it releases a monthly water supply outlook and snow survey bulletin, which predicts water availability for the remainder of the year. By June, the bulletin can offer a close estimate.

South of Calgary most farming depends on a regular supply of irrigation water. In a river system like the Bow, flow forecasts are vitally important. Not only do several irrigation districts need water, but there are competing demands for industries such as Calgary Power, for a constant flow of water through Calgary to dilute river pollution, and for the fish population in the river. Alberta Environment regulations and interprovincial and international apportionment agreements set the downstream water needs, and restrict the water which may be diverted for any use.

Water use is highly complex, yet an all-important element of life. Constant accurate information, including the predictions of the Alberta river forecast centre, reduces water's hazards and enhances its gifts.

Susan Mayse is a freelance writer living in Edmonton.

Elizabeth McLean

A Dam Site Safer!

Incidents, but no accidents — that's Alberta's dam safety record.

Thousands of Albertans will be relaxing this summer somewhere in the vicinity of a dam. Thousands more live near dams, and depend on them for water supply, hydro power and irrigation.

So ensuring that the province's dams are safe is a major responsibility, carried out by Alberta Environment's dam safety branch.

Branch head Inge Anderson points out that dams were built by the Egyptians 5,000 years ago and that dam safety has been of concern to administrators of water ever since. In his files he keeps a copy of a section of one of the oldest recorded laws, the famous Code of Hammurabi, the sixth king of the Amoritic dynasty of Babylonia, who reigned around 1700 B.C. Section 53 of the Code, written for the use of courts throughout the empire, states:

> *If any one be too lazy to keep his dam in proper condition, and does not keep it so; if then the dam breaks and all of the fields are flooded, then shall he in whose dam the break occurred be sold for money and the money shall replace the corn which he has caused to be ruined.*

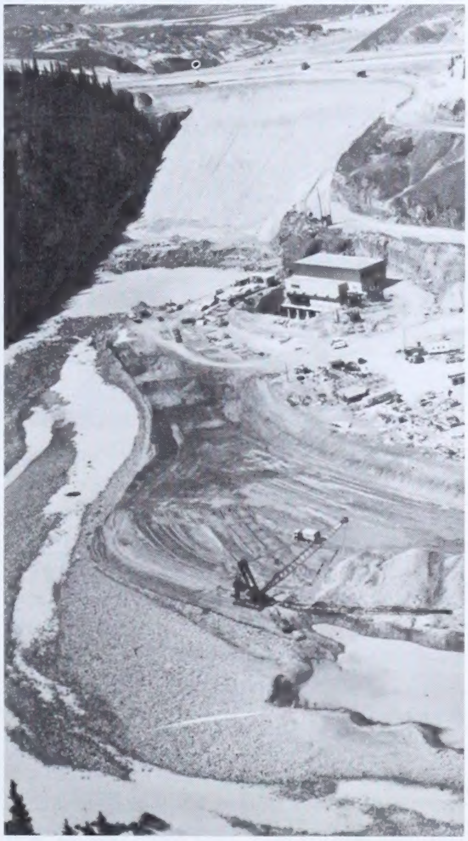
No such ironhanded penalties are prescribed by Alberta legislation. But pursuant to the provisions of the Alberta Water Resources Act, fines of up to $5,000 can be imposed.

Although other provinces perform some dam safety supervision under their water resources acts, Albertå is the only province in Canada to have a regulation pertaining specifically to the operation and safety of dams. The dam and canal safety regulation came into effect in September, 1978, under the Waters Resources Act. It applies to the 1,200 or so dams in the province which exceed 7.5 metres in height and 50 acre-feet in capacity.

Guidelines have been drawn up which outline inspection procedures to be followed to ensure the safety of dams, specify conditions under which dam repairs, alterations or replacements can be made, prescribe procedures for abandonment and removal of dams and list steps to be taken in case of hazard or emergency.

Basically the licensee of a dam is required to arrange for safety inspections by government officials, to provide them with any information required to evaluate the condition of the dam, to make any repairs or improvements the officials recommend, and generally, to operate the dam in a manner consistent with public safety.

Though no local dam tragedy prompted the Alberta legislation, safety regulations like these are usually born following a major disaster which alerts the public and the professionals to the inadequacy of existing safety procedures. In the United States, for example, dam safety became a national issue in 1972 when two dam failures in four months, in West Virginia and South Dakota, left 355 people dead and caused $150 million worth of damage. The National Dam Inspection Act was rushed through Congress two months later. The first United Kingdom legislation was passed in 1930 following a major dam failure in North Wales.


The Big Horn Dam during construction.

Alberta's dam safety program is carried out by the dam safety branch. The branch consists of five engineers and five technologists who go to locations all over the province to make on-site inspections of existing dams and to inspect construction of new projects.

Dams have been erected throughout Alberta for purposes of water diversion, irrigation, flood control, domestic and industrial water supply, wildlife conservation, as well as recreation such as boating and fishing. Most structures have more than one use and may serve, for example, industry, irrigation and recreation interests.

Although the government of Alberta owns several large structures built mostly for irrigation, over 95 per cent of dams in the province are privately owned. The owners are likely to be power companies which use water for power generation, oil companies that need water for oil field injection, ranchers and individual farmers whose livestock depends on a good source of water.

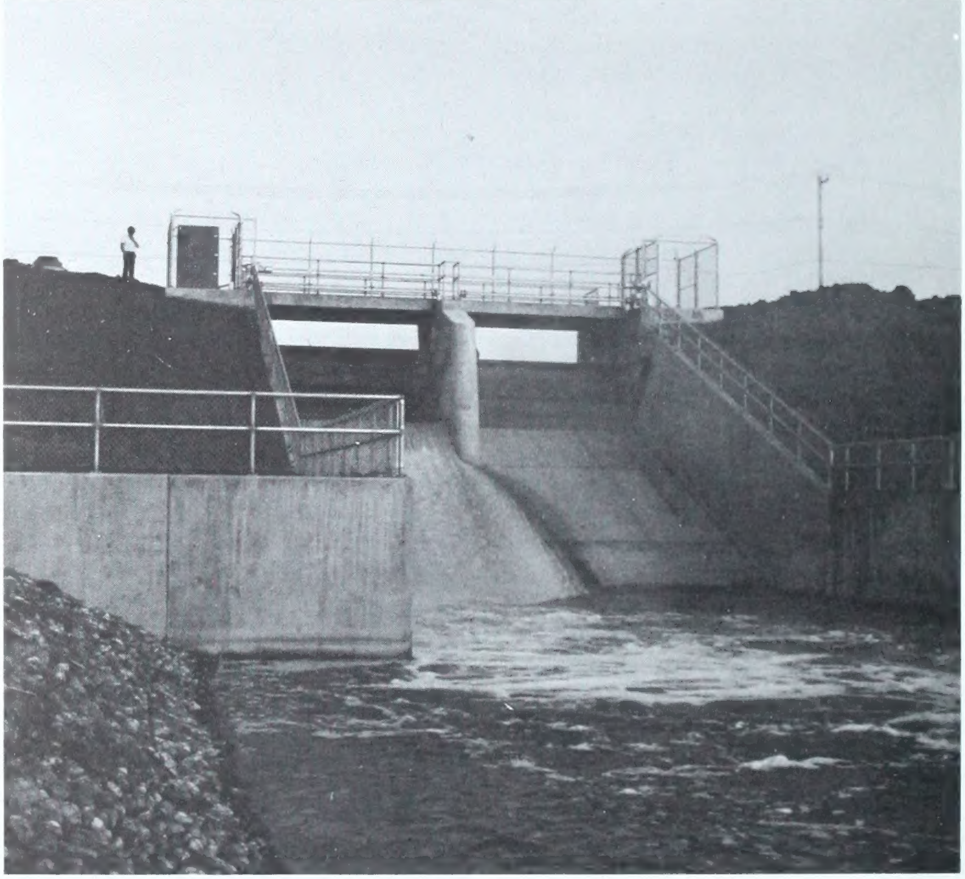
One of the largest builders and managers of dams in Alberta is Ducks Unlimited, which operates more than 500 dams, some of them very small. *(For more information about Ducks Unlimited, see the story on Page 22).*

Alberta's dams are mostly earthfill. An earthfill dam consists of the main embankment, usually constructed across a natural water course, and such dikes, spillways, and riparian or canal outlets as are required to impound water in the reservoir. The biggest dam in Alberta, the 91-metre-high Big Horn, situated west of Rocky Mountain House, is an earthfill dam.

Most small earthfill dams are classified as homogeneous because the embankments consist of essentially the same type of soil throughout the structure.

Larger structures, that contain areas of clay and granular materials, are classified

Dam safety branch photographs taken during inspections of dams at Beauvais Lake (right) and Grande Prairie (below right).



as zoned fill. These structures consist of a central core of well compacted clay material to act as an impermeable barrier to retain water in the reservoir, and other layers of granular material such as clean gravel and rock to provide stability and drainage. Very large dams are often built with concrete, but there are only half a dozen or so of these in Alberta.

Although all dams must be inspected from time to time, some dams are checked more often than others. Dams located upstream of populated areas are classified as "high risk" and an especially watchful eye is kept on them. The Glenmore dam in Calgary belongs in that category; so do some irrigation headwork structures in the Lethbridge area.

When they arrive on the scene, dam safety branch inspectors look for three basic types of failures: structural, hydraulic and seepage. Structural failures may be caused by unstable embankments or foundations. Two years ago, during a flood, water went over the top of the dam at Rainbow Lake causing structural damage.

Hydraulic failures are the result of uncontrolled flow of water over dams and from surface runoff, or erosion by waves in the reservoir. They are caused by inadequate spillway capacity, insufficient protection against erosion, clogging of spillway with debris or poor surface drainage. A spillway failure occurred last year at Vermilion Dam.

Seepage failures occur because of leaking conduits, or concentrated seepage along the downstream slope. They result in progressive erosion of material from the downstream side of the dam or foundation toward upstream, and may eventually lead to a breach in a dam section.

To counteract such failures, safety inspectors can recommend preventive and/or remedial measures: providing drainage trenches, filters or relief wells; the flattening of slopes; construction of berms to increase stability; placement of well-graded riprap and filters; removal of accumulated debris; replacement of conduits; and many others.

Dam construction is a tedious and prolonged business. It may take four to six years to design and construct a major dam. Two or three years are necessary to locate the site, conduct public hearings and produce a suitable design, and another two to three years are needed for the actual construction. Dam maintenance is equally exacting in order to prevent the disaster of a dam failure.

Although statistics indicate that one in 100 dams in the world is failing, Alberta's record of safety in this respect is good. In the 75 years since this province joined Confederation, there is no record of any loss of life due to an Albertan dam failure.

True, there aren't many big dams in Alberta. But sometimes the failure of even a small dam can bring tragic consequences. In 1977 an 11-metre-high dam at Taccoa Falls in Georgia collapsed, killing 39 people. Inspectors found it to have been in a deplorable state of disrepair. Georgia was then one of the nine states still without dam safety laws.

In Alberta there have been dam incidents by no serious dam accidents. The dam safety program is aimed at keeping the record good.

Elizabeth McLean is a freelance writer living in Edmonton.

Letters to the Editor

Environment Views welcomes letters pertaining to environmental concerns and/or response to articles in past issues of the magazine. Publication of the various opinions in no way implies endorsement by either Alberta Environment or this magazine. Letters must be signed, and Environment Views reserves the right to edit them for length.

Concern Over 'Assimilative Capacity'

In response to *Environment Views* April May 1980, page 3 (*Sewage Disposal* by Gillian Sniatynski), concerning assimilative capacities of large rivers like the North Saskatchewan, I offer the following:

First of all, the present government's philosophy is best described by two quotes. At the 1973 Public Advisory Committee on the Environment annual conference, Mr. Bill Yurko, then Minister of Alberta Environment, stated that: "The assimilative capacity of some of Alberta's waterways is to be considered as an economic resource since we are a partial frontier society." In 1974, Mr. Yurko said that "whereas the U.S.'s ultimate goal is zero discharge, our policy is still one of using our waterways to assimilate wastes. The economic burden of zero discharge upon industry and municipalities would be too restrictive at this stage in our province's development and water quality protection is under the Clean Water Act." My recent correspondence with Mr. Cookson does not indicate, nor is there any other evidence to indicate, that this philosophy has changed.

Let's first look at the term "a partial frontier society." I suppose it depends on an individual's own definition, but my concept of a partial frontier society is tuned to the 1930s in North America and the present condition in some Third World countries. It certainly is not a society that employs sophisticated technology and buildings, produces complex materials, chemicals, plastics, and reagents, utilizes complex transportation systems, nuclear power and water, and space technology.

The best meaning and interpretation of "assimilative capacity" is given by Alberta Environment. "It is generally interpreted to mean that concentration of a specific contaminant or combination of contaminants in either the ambient air or surface waters which if exceeded, may have a significant effect on the ecological systems found in any particular area of the province."

It appears that the Clean Water Act is designed to reduce pollution by controlling the construction and operation of those projects likely to create pollution. The Act apparently does not control pollution through specific regulations for permissible concentrations of particular water pollutants. Water pollution is apparently controlled by a general prohibition against the deposit of deleterious substances in water courses. According to the Act it appears that a deleterious substance includes those substances that render the water harmful to fish, wildlife, livestock or domestic animals. It does not include humans! Under the Act, sewage treatment plants etc., are given a permit "to pollute" which includes a particular allocation (based on dissolved oxygen and cubic feet per second of river flow) of B.O.D. (Biological Oxygen Demand), of phosphorus, and nitrogen to be dumped into the river.

There is ample evidence of the biological and chemical impact of Edmonton and surrounding industrial complexes on the North Saskatchewan River. A simple comparison of available data collected upstream of Edmonton and downstream of Edmonton and Fort Saskatchewan will reveal the impact.

As far as I am concerned the present assimilative philosophy is out-of-date, not tuned into today's technological society and is the basis for most of our environmental insults in Alberta, which of course know no provincial boundaries.

Dennis Wighton,
Co-ordinator,
Interdisciplinary Committee for
Environmental Quality,
University of Alberta

Land Application Of Wastewater Questioned

Concerning the article "Taking the 'Waste' Out of Wastewater" in the April-May issue of *Environment Views*, I wish to take issue with blanket statements that land application of wastewater is safe.

Volume 17 of the journal *Groundwater* details proceedings of the Fourth National Groundwater Quality Symposium organized by the Environmental Protection Agency and National Water Well Association in the U.S. After reviewing the papers presented, one comes to the conclusion that the term "safe" can hardly be used to describe the land application method.

Like so many other disposal practices, there is a lack of sufficient data to understand the long-term effects of land application. As one author states in his paper, at this moment in time we are proceeding in ignorance.

In addition, Mayor Wentz's delight over the $20,000 return on the cash crop sale may in the long term turn into feelings of dismay. Because of such returns on investment dollars with this form of waste treatment, communities are jumping on the bandwagon hoping to recoup some of their money. However the safety of the method has not been validated and we may be haunted in the future by effects we have yet to assess.

We must be aware of more than the dollar flow column of our environmental accounting. At stake is the health of our society. To apply wastewater to land used for cash crops seems to me to be a procedure to be approached with much skepticism. After all, we were told that landfills were our "safe" answer to waste disposal and now we are faced with the problem of leachates and groundwater contamination.

Gregory Csullog,
Vegreville.

If undelivered, return to:

Environment Views
Alberta Environment
9820 - 106 Street
Edmonton, Alberta T5K 2J6

Environment Update

Water Conference At U Of A

The Alberta branch of the Canadian Water Resources Association and the University of Alberta's water resources centre are sponsoring a conference on August 27 and 28 on the role of interbasin transfers in water resources management in Alberta.

The conference, to be held in the Tory Building of the University of Alberta, is intended to cover a wide subject range and present arguments for and against transfer. Papers on all aspects are invited.

For further information, contact Walter Francl (451-3620), Jim Wohl (484-1187) or Dr. Arleigh Laycock (432-3287).

Turnout Disappoints

The end of June will also see the end of 20 days of hearings in 16 different locations on the issue of hazardous wastes disposal in Alberta.

The hearings, conducted by the Environment Council of Alberta (ECA), have attracted a satisfactory number of good-quality submissions, says ECA communications officer Ken Nelson. But he adds that, in view of the great interest shown in the information meetings held prior to the hearings, there has been some disappointment about the relatively poor turnouts at the hearings.

Noise Hearings Planned

The Environment Council of Alberta (ECA) is now making plans for hearings early in 1981 on the effects of noise on the environment.

Those interested in learning more about the hearings, or wanting to participate, should contact the ECA at 427-5792 (for Edmonton callers) or Zenith 06075 (for callers outside Edmonton).

Flood Study Report Out

The interim report of the Elbow River flood study has been published, and Alberta Environment's public participation branch in Calgary is seeking input from the public on some of its suggestions.

The report makes no specific recommendations, but presents several options for flood plain management, including raising the dam on the Glenmore reservoir; diking; or taking no action.

A summary of the report is available. Those interest in receiving it should write to:

Linda Hansen,
Alberta Environment
Public Participation Branch,
14th floor, Rocky Mountain Plaza,
615-2nd St. SE,
Calgary T2G 4T8.
Phone: 261-6586.

Action On Growing Pains

Concern about rapid growth has prompted some community action in the town of Grande Prairie.

The town's United Way organization has agreed to sponsor a community assessment of the situation. A steering committee of eight people, representing various interests in the town, has been established, and funding has been sought from the Northern Alberta Development Council.

It's anticipated that consultants will be hired to undertake further studies which the community will consider.

Plant To Clean Up Wastes

Closure of the CIL plant in Calgary, and the proposed sale and reuse of the plant site, means a major clean-up operation for the firm.

Over the years, thousands of gallons of chemical wastes have been buried in special drums on the site. The drums will have to be retrieved, and the chemicals — including some mercury wastes which require especially careful treatment — must be properly disposed of.

Plant closure is scheduled for September, and the company hopes the clean-up operation (which Alberta Environment will monitor) will be completed by March, 1981.

Genesee Plant Approved

Alberta's Energy Resources Conservation Board has given approval to the application by Edmonton Power to build a $700 million coal-fired power plant at Genesee, some 60 kilometres west of Edmonton.

The company has been seeking approval for more than three years to proceed with the plant and a related strip mine. Local landowners have however opposed the project, which must still be cleared by the provincial cabinet.

The ERCB has also deferred an application by Calgary Power Ltd. to expand its Keephills thermal station. The board said the application will be considered later in consideration of future electric power requirements.

If you have a short news item of province-wide interest you'd like to contribute to Environment Update, please send it to the editor at the address on the Contents page. The editor reserves the right to select and edit the items.